United States Patent [19]

Bombardi

[11] **3,823,638**

[45] **July 16, 1974**

[54] **PAGE TURNING MECHANISM**

[76] Inventor: **Aldo L. Bombardi,** 202 Smull Ave., North Caldwell, N.J. 07006

[22] Filed: **Jan. 10, 1973**

[21] Appl. No.: **322,420**

[52] **U.S. Cl.** **84/503,** 84/509, 84/511

[51] **Int. Cl.** **G10g 7/00**

[58] **Field of Search** 84/502, 503, 505, 507, 84/508, 511, 512, 513, 515, 509

[56] **References Cited**

UNITED STATES PATENTS

217,473	7/1879	Moore	84/503
582,050	5/1897	Fletcher	84/503
763,201	6/1904	Nossardy	84/503
794,126	7/1905	Shaw	84/511
3,732,773	5/1973	Bombardi	84/491

Primary Examiner—Lawrence R. Franklin
Attorney, Agent, or Firm—Edward Goldberg

[57] **ABSTRACT**

A plurality of pulleys and cables are secured respectively to a plurality of cooperating rotatable vertical wire rods which have horizontal extensions at each end and vertically disposed clear plastic strips connected between the ends for holding and turning pages. The cables are connected to horizontal slidable bars which are controlled by movement of a vertical cam plate, rack and pawl mechanism in one direction to turn individual rods and pages from right to left upon each movement of a first lever. A second lever and linkage and oppositely acting pawl, rack and cam turn the rods and page holders in the reverse direction from left to right. A rapid turning mechanism can successively turn all of the rods back and forth while bypassing the lever and pawl mechanism.

12 Claims, 24 Drawing Figures

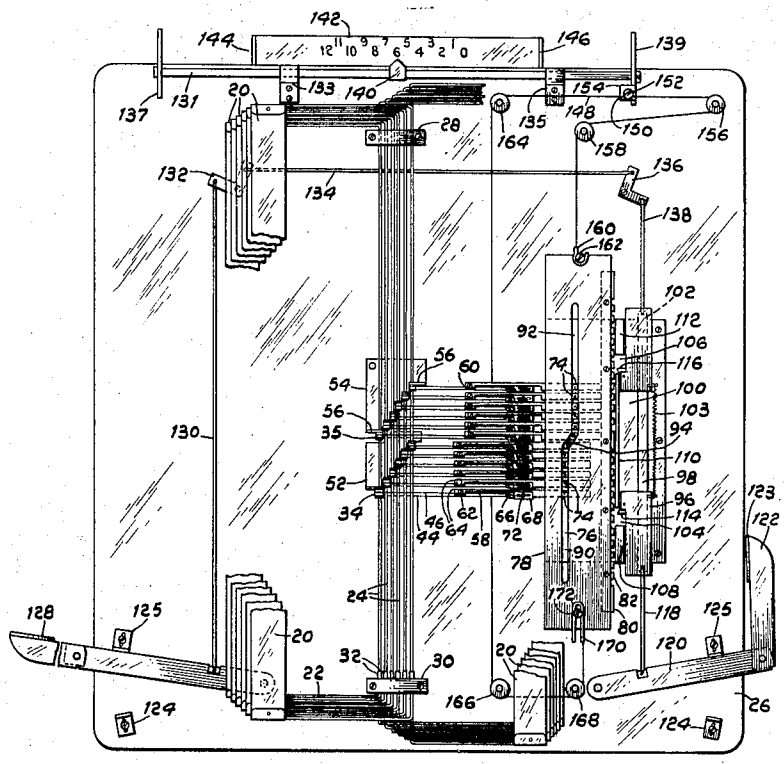


Fig. 1

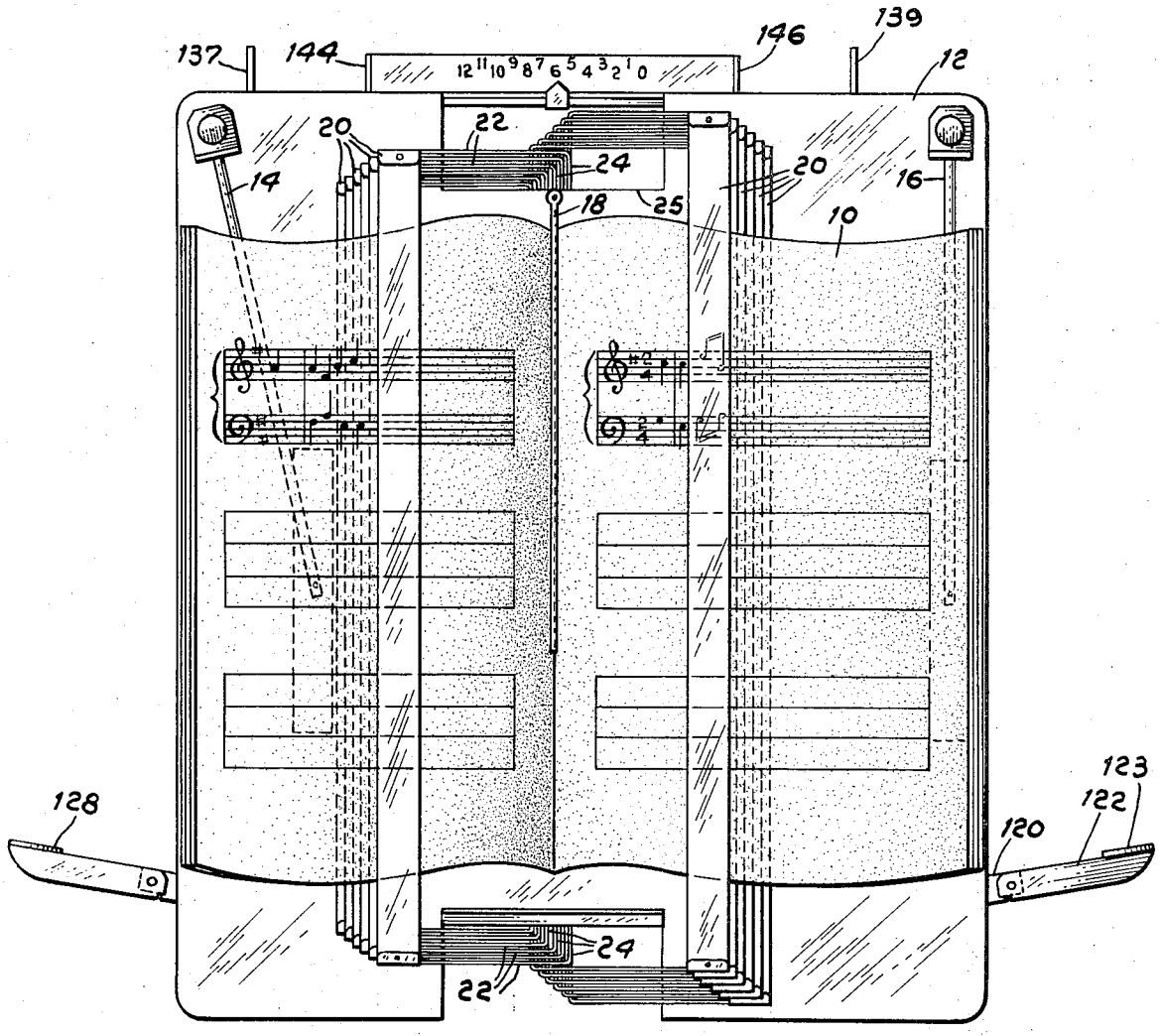


Fig. 4a

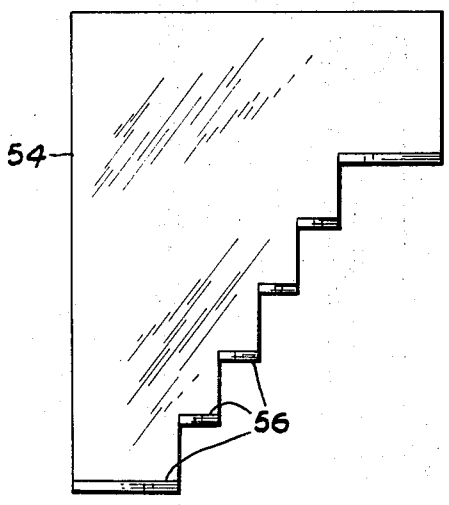


Fig. b

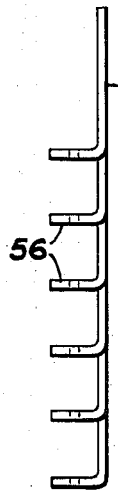


Fig. 4c

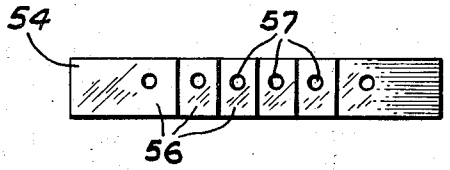


Fig. 2

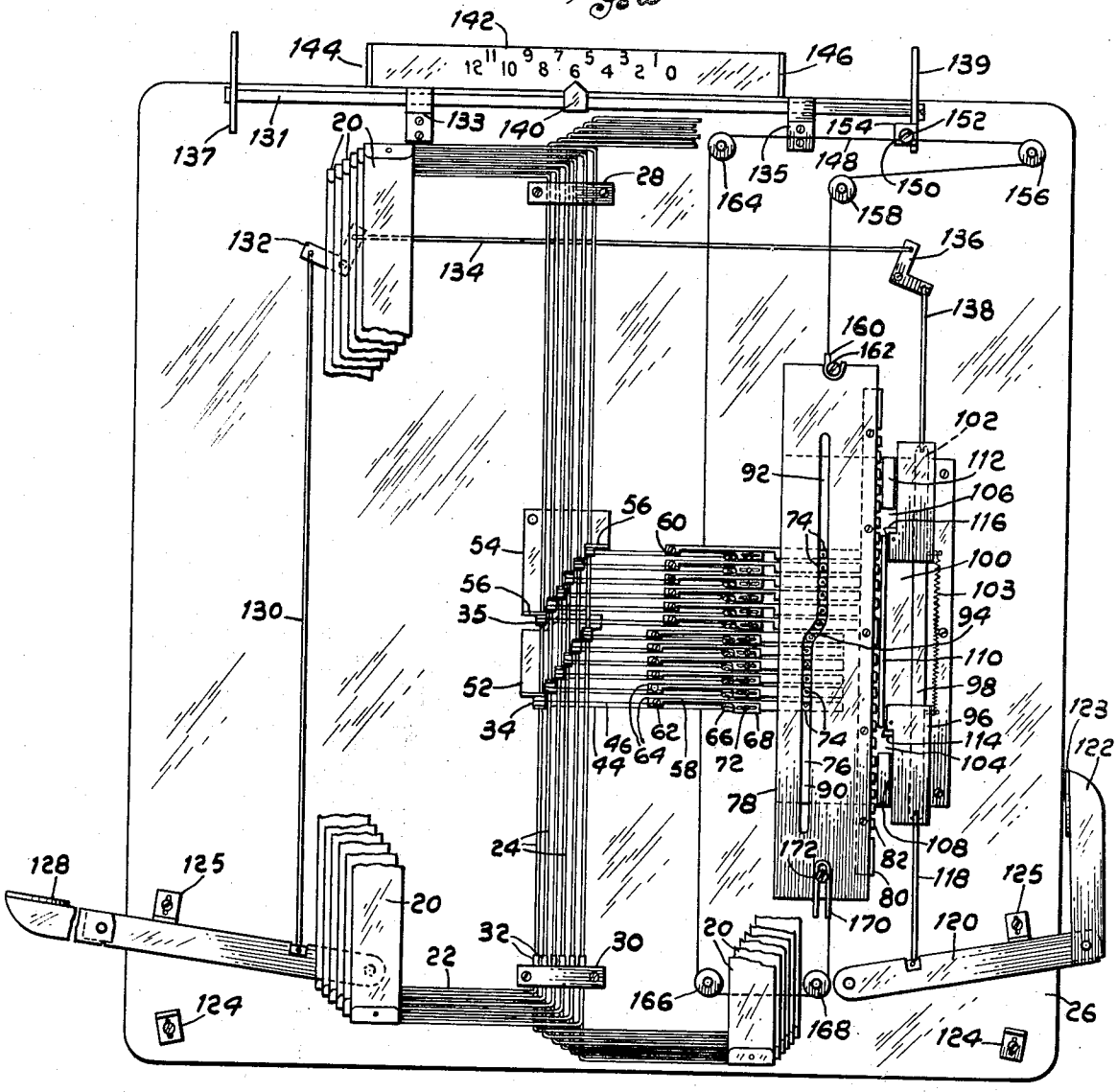


Fig. 5a

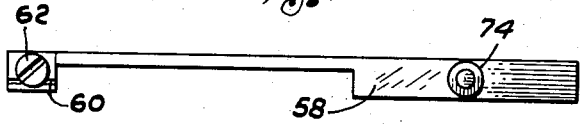


Fig. 5b

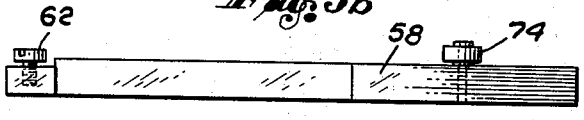


Fig. 5c

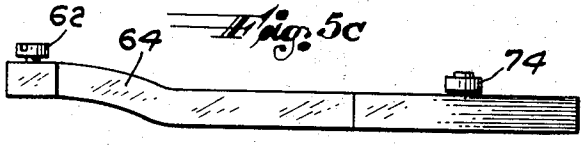


Fig. 6a

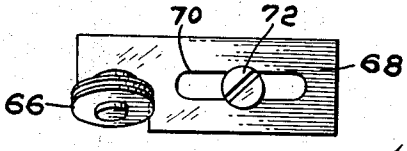


Fig. 6b

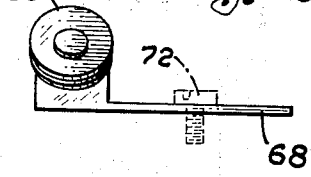
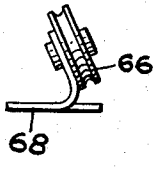


Fig. 6c



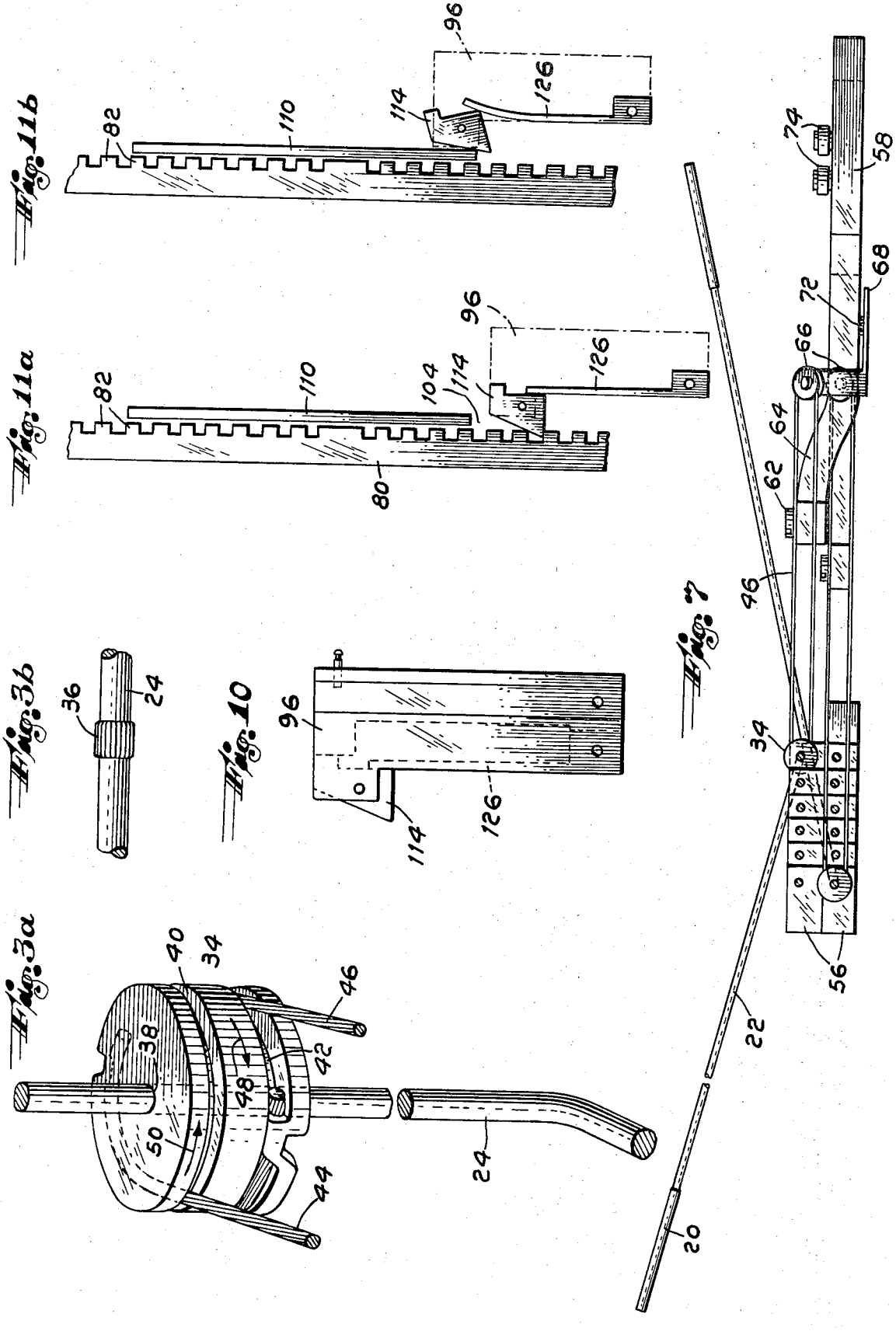

Fig. 11b
82
110
114
126
96
Fig. 11a
82
110
104
114
126
96
80
Fig. 3b
36
24
Fig. 10
96
114
126
Fig. 3a
40
34
46
38
42
48
50
44
24
Fig. 7
74
58
68
72
66
64
62
96
34
56
22
20

Fig. 8a

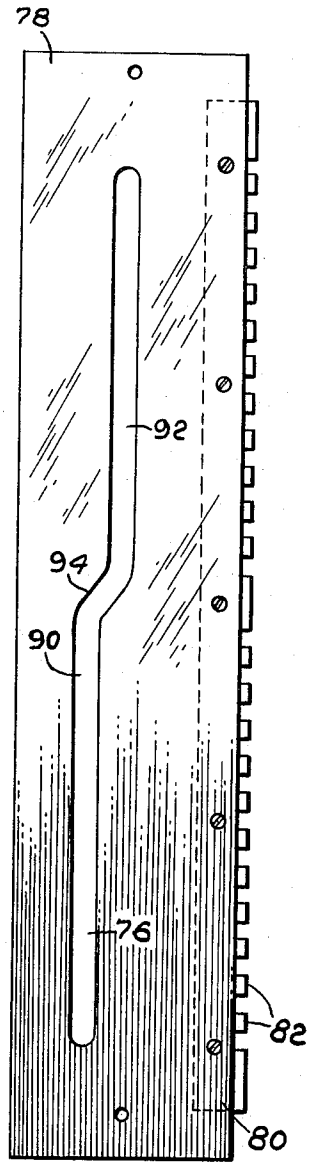


Fig. 8b

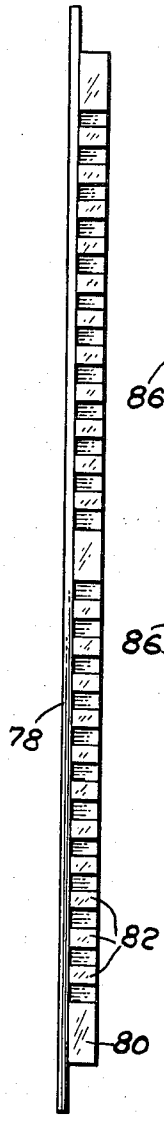


Fig. 9

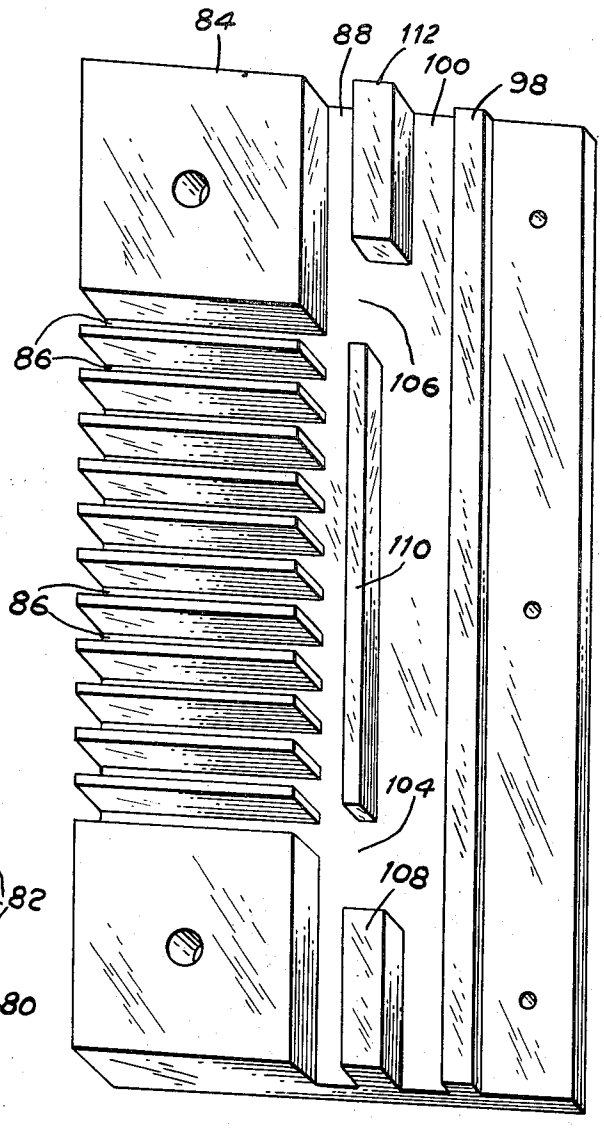


Fig. 8c

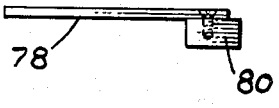


Fig. 12a

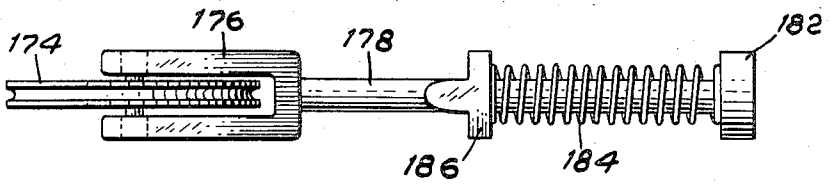


Fig. 12b

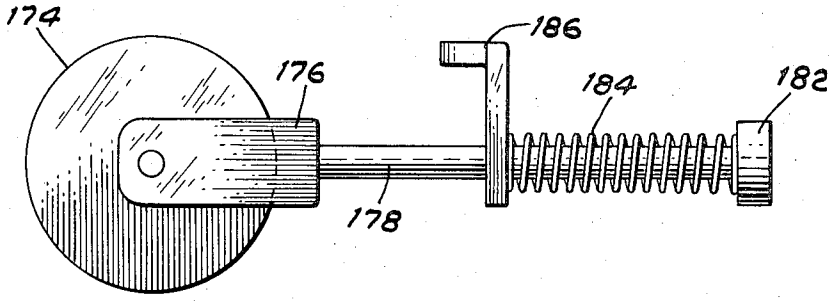
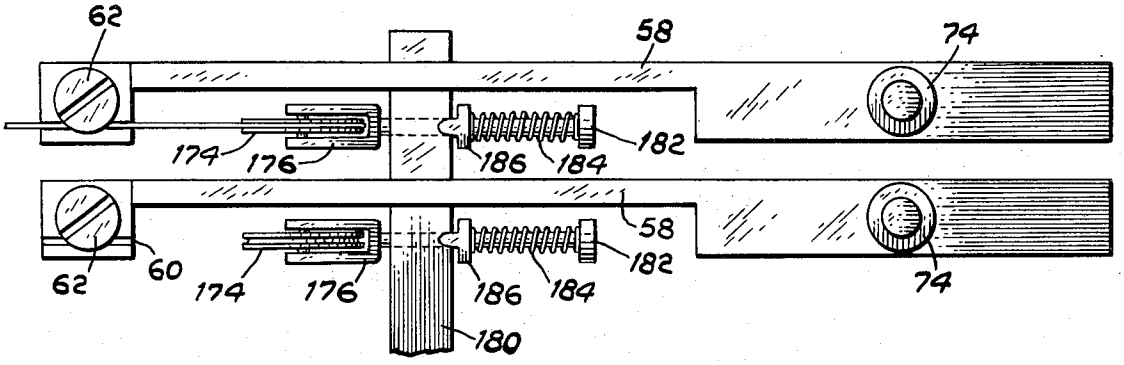


Fig. 12c



PAGE TURNING MECHANISM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to mechanical page turning devices and particularly to an improved more reliable efficient page turner which rapidly turns the pages in either direction by direct rotation of vertical rod page holders.

2. Description of the Prior Art

A previous device for turning sheets of music or pages of various types of publications has been described in a copending application by the present inventor now issued as U.S. Pat. No. 3,732,773 on May 15, 1973. In that device, a plurality of vertical rods having horizontal extensions at each end and vertically disposed clear plastic strips connected between the ends for holding pages was rotated from one side to another by biased helical torsion springs secured around each respective rod. Each rod rotated about a separate vertical axis in support bushings and adjacent horizontal ends were spaced vertically with each rod end being held in a slotted latching bracket. Vertical movement of a slidable rack and pawl released each end from the latch so that the spring would cause the rod to swing from right to left while carrying and turning a page. The rods were returned manually to the latched or loaded postion. This device thus relied upon the torsion of each spring to turn the rods and required somewhat critical adjustments of various elements to achieve the necessary continuously repetitive operations. In addition, it could not operate automatically in both directions.

SUMMARY OF THE INVENTION

It is therefore the primary object of the present invention to provide an automatic page turner of improved reliability and efficiency wherein the vertical rods are turned by direct positive mechanical rotation of a pulley and cable arrangement and a reversible control mechanism which operates in either direction.

This is achieved by a novel coupling and control mechanism wherein a pulley and cable are secured around each vertical rod page holder. The cables are guided around a second group of idler pulleys and are connected to respective horizontally slidable bars which engage horizontal channels in a stationary vertical guide block. Each bar has a cam follower roller at the end which rides in a vertical cam slot having two offset portions along a vertically movable plate. A first lever controls a first vertically movable pawl which engages successive individual teeth in a rack along one side of the plate to move the plate in one direction and change the horizontal position of the rollers and bars along the cam slot. Movement of the bars then rotates the cables and pulleys to turn the respective individual rods and pages from right to left. A second lever and symmetrical vertical pawl and rack along a second portion of the plate selectively moves the plate, cam slot and bars in the opposite direction to return the rods from left to right into the starting position. A faster operating pulley and cable mechanism bypasses the levers and pawls to provide rapid turning of the rods successively in either direction. The details of the invention and other objects and advantages will become apparent

from the following description in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a front view of the novel device showing two groups of page holders with sheets of music of a publication on opposite sides of a base plate;

FIG. **2** is a partial front view with the front base plate removed to show the vertical rods, attached pulleys and cables, vertical cam, pawl, rack and control mechanism;

FIGS. **3***a* and **3***b* show a partial enlarged isometric view of a pulley and cable about a rod and a section of rod secured within a pulley;

FIGS. **4***a*, **4***b* and **4***c* show front, side and end views of a pulley support bracket;

FIGS. **5***a*, **5***b* and **5***c* show a front and end view of a typical horizontal bar and roller connected to the back group of rods and an end view of a bar for connection to a rod in the front group;

FIGS. **6***a*, **6***b* and **6***c* show front, end and side views of an idler pulley and cable tension adjuster;

FIG. **7** is an end view of a typical front and back rod assembly and control mechanism;

FIGS. **8***a*, **8***b* and **8***c* show front, side and end views of the vertical camplate and rack;

FIG. **9** is a front isometric view of the guide block for the horizontal bars, vertical cam plate and pawl assembly;

FIG. **10** is an enlarged front view of a pawl assembly;

FIG. **11***a* and **11***b* show partial views of the pawl engaging and disengaged from the vertical cam plate rack; and

FIGS. **12***a*, **12***b* and **12***c* show front, end and front assembly views of an alternate embodiment for an idler puller and cable tensioning device.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in FIG. **1**, pages of a publication, such as sheets of music **10** which are to be turned automatically, are supported on a base plate **12**, with the front and back covers or unused outer groups of pages secured in position by adjustable clamps **14, 16** on opposite sides of the base plate. The center fold of the pages is preferably held in position by a resilient central clamp **18.** The selected group of pages which are to be turned mechanically are individually inserted between respective pairs of longitudinal clear plastic strips **20** which engage both sides along the full length of each page. Each set of strips is connected in a front and back pair to respective horizontal rod end portions **22** which extend from opposite ends of respective vertical rotatable rods **24.** 12 such pairs of strips and rods to accommodate 12 pages are illustrated in this example. A central area **25** at the upper end of the base plate **12** is cut out to provide an area in which the rod ends are turned. The structure of the rods and plastic strips is more fully described in the aforementioned earlier U.S. Pat. No. 3,732,773 which employs a different drive and control mechanism.

FIG. **2** is a view of the present device with the front base plate cover removed to show the details of the internal mechanism. The vertical rods **24** are rotatably supported on a back base plate **26** by two bushings **28, 30** adjacent opposite ends of the rods. The bushings

each have two rows of six holes, one over the other, to provide separate spaced vertical axes about which the individual rods turn. The rods are arranged in two groups of six in front and back tiers corresponding with the two rows of holes in the bushings. As shown, the front tier of rods is turned to the left side of the base plate and the back tier to the right. Metal sleeves **32** around the rods at the lower end bushing **30** provide alignment and prevent undesired longitudinal movement of the rods in the downward direction.

The horizontal ends **22** of the rods are all spaced vertically from one another so as to minimize overlap and interference during turning. The rod ends have a generally outward slant at a suitable angle from the base and vertical axis, as shown in FIG. **7**, to accommodate the height of the underlying longitudinal plastic strips which each rest upon the immediately preceding strip when successively turned in the same direction. As shown in FIG. **2**, the front row beginning with the rod on the left is turned first during successive movement from right to left, while the reverse direction starts with the rods in the back row on the right.

Secured in the mid-section along each of the rods, at different stepped vertical and horizontally spaced postions, are a plurality of driver pulleys **34, 35** arranged in corresponding front and back rows of six. The back row **35** is also spaced vertically upwardly along the base from the front row **34.** A typical pulley is shown in more detail in FIG. **3***a*. Each pulley is fastened about a respective vertical rod which may have a splined knurled shaft surface **36,** as shown in FIG. 3b, to fit tightly within a central bore **38** in the pulley. Each pulley has two annular grooves **40, 42** which respectively accommodate two ends **44, 46** of a twisted strand wire cable. The cable ends are crimped into the grooves at segments approximately **180** apart so that one cable end **44,** with FIG. 3a viewed along the bottom of the page, extends horizontally to the right from the lower back end of groove **40** of pulley **34** and the other cable end **46** extends in the same direction from groove **42** at the top front of the pulley. Tension on the front cable portion **46** will thus pull and rotate the pulley and rod clockwise or to the right, as indicated by arrow **48,** while tension on the lower back portion **44** will rotate the pulley and rod counterclockwise or to the left, as shown by arrow **50.**

The pulleys in each group of six are successively spaced in equal steps upwardly from left to right along each respective adjacent rod. The pulleys are secured in two groups on brackets **52, 54** which respectively support the pulleys associated with the front and back tier of rods. Bracket **52** is raised from the base plate to support the front tier of pulleys. Bracket **54** is disposed vertically toward the upper end along the rods with respect to bracket **52.** FIGS. 4a, 4b and 4c illustrate front, side and end views of bracket **54** in further detail. The upper flat side of each respective pulley abuts a corresponding end flange **56** on bracket **54** and similar flanges on bracket **52.** Flanges **56** have holes **57** to accommodate the rods and prevent upward movement of the pulleys and rods to aid in maintaining the longitudinal position of the rods.

The opposite ends of the cables from pulleys **34, 35** extend horizontally in different lengths to a plurality of equally vertically spaced horizontally movable bars **58,** each associated with a respective pulley and rod. The lower group of six bars is connected by the cables to the front lower tier of pulley **34** on bracket **52** and the upper group of bars is connected to the upper rear pulleys on bracket **54.** FIGS. **5***a*, **5***b* and **5***c* show a front and end view of a bar associated with a rear pulley and an end view of a bar connected to a front tier pulley. Each bar has a slot **60** in the left end and a screw **62** which accommodate and clamp a section of the cable so that horizontal movement of the bar pulls the cable and pulley. The left end **64** of each front tier bar is curved forwardly to meet the level of the cable from the front tier pulleys.

Secured to the base plate in an aligned vertical row along the central area of the bars **58** are a plurality of idler pulleys **66** rotatably mounted on cable tension adjuster brackets **68,** shown in further detail in top, end and side views in FIGS. **6***a*, **6***b* and **6***c*. The extending portion of each cable fits around the groove in each idler pulley, so that the front cable portion **46** from a pulley **34, 35** is clamped in slot **60** of each bar **58** and is then looped over the front of idler pulley **66** and under the back to return to the other cable end **44** secured to the back of pulley **34, 35.** Each idler pulley **66** is supported in a freely rotatable angled vertical position at the end of a tension adjuster bracket **68.** A horizontal slot **70** and screw **72** secured to the base plate permit horizontal movement of the bracket to take up any slack in the cable and maintain a suitable tension therein. The idler pulley thus guides and is driven by the movement of the cable. The group of brackets **68** and idler pulleys **66** for the front tier of bars and rods are also raised above the level of the back tier brackets to meet the cables from the respective front tier driver pulleys.

FIG. **7** shows an end view of a typical front and back rod, driver pulley, cable, bar and idler pulley assembly. Mounted at the other end of each bar **58** is a freely rotatable cam follower or roller **74** which is adapted to engage a vertical slot **76** in a vertically movable cam plate **78** shown more clearly in front, side and end views in FIGS. **8***a*, **8***b* and **8***c*. Behind the cam plate along one side is secured a rack **80** having a plurality of teeth **82** extending from the side. Cam plate **78** is slidably mounted over a stationary guide block **84,** as shown in a top isometric view in FIG. **9,** which is secured on baseplate **26.** The guide block includes a plurality of horizontal channels **86** which receive and guide the movement of horizontal bars **58** and a vertical channel **88** which accommodates and guides toothed rack **80** secured to cam plate **78.** The rollers **74** of bars **58** engage the vertical slot **76** of the cam plate. The vertical slot includes two horizontally offset portions **90, 92** and curved connecting passage **94** so that upward movement of the cam plate along block **84** causes the rollers to successively move from the upper right slot **92** through passage **94** into the lower left slot **90** thus causing respective bars, cables, pulleys and rods to move from right to left. Reverse movement of cam plate **78** downward causes rollers **74** to move from lower left slot **90** through passage **94** to upper right slot **92,** with respective bars, cables, pulleys and rods all moving successively from left to right.

Positioned alongside the lower end of rack **80** and teeth **82** is a vertically movable pawl assembly **96,** as shown in FIG. **10,** which is guided along vertical bar **98** and channel **100** of guide block **84.** A like symmetrically positioned pawl assembly **102,** shown in FIG. **2,** is disposed along the upper end of rack **80** and is con-

nected by a spring **103** to the lower pawl. The pawl assemblies **96, 102** are positioned adjacent longitudinal openings **104, 106** along vertical bars **108, 110, 112** so that the pawls **114, 116** extend through the openings to engage teeth **82** of rack **80.** The pawl assembly **96** is connected by a vertical rod **118** to a horizontal control lever **120** having an extension **122** with a plate **123** which normally extend horizontally from the right side of base plate **12.** Downward pressure on plate **123** and levers **122** and **120,** such as by a finger of a person desiring to turn pages, pulls rod **118** and pawl **114** in the down direction. The pawl, which is normally maintained in a disengaged position by spring **103** and bar **110,** as shown in FIG. **11***b*, is then pulled into opening **104** to pivot into engagement with a tooth **82** on rack **80,** as shown in FIG. **11***a*. This moves the rack downwardly a distance equal to the spacing between teeth. The rack in turn moves cam plate **78** and slot **76** down to cause a roller **74** to move to the right along with a bar **58** and thus turns a pulley **34, 35,** cables **44, 46** and rod **24** from left to right.

Adjustable limit stops **124, 125** are positioned above and below lever **120** at the proper spacing to limit the movement to the correct distance. Typical spacing between corresponding points on adjacent teeth may be ¼ inch with the teeth being ⅛ inch in height. The pawl assembly includes a lever spring **126** which urges the pawl into engagement with the teeth. When lever **122** is released, spring **103** pulls the pawl assembly back into the normally disengaged position, with the pawl pivoting counterclockwise and cocking lever spring **126** for the next downward movement. Bar **110** also normally prevents pawl **116** at the other end from engaging teeth when not properly actuated in the reverse direction and spring **103** maintains the pawls and levers in a neutral position.

The reverse operation to move rack **80** in the upward direction and turn pages from right to left is initiated by pressing down on control lever **128** and the lower left side of the base plate. This pulls vertical connecting rod **130** downwardly, pivoting an L-shaped connecting lever **132** counterclockwise and pulling horizontal rod **134** to the left. A second L-shaped lever **136** is also pivoted counterclockwise to pull vertical rod **138** and pawl assembly **102** upwardly. Pawl **116** then pivots through opening **106** into engagement with an upper tooth **82** in rack **80** to move cam plate **78** upwardly. This moves a roller **74** and bar **58** to the left and the connected driver pulley, cable and rod turn to the left carrying a page therewith. Successive movements of levers **122** or **128** on either side cause successive movements of the rods in a respective direction until all rods and pages are turned to one side of the base plate. In some applications a foot operated pedal may replace the hand operated levers, if so desired. In addition, various components such as the pawl assemblies, toothed rack and guide block may be made of suitable plastics material.

At certain times, it may be desirable to quickly turn all or some of the pages in either direction with one continuous rapid movement without turning each individual page intermittently with the control levers. For this purpose, a rapid turning mechanism is provided which bypasses the rack and pawl mechanism. This is accomplished by a horizontally movable control rod **131** slidably mounted in two support bushings **133, 135** secured at opposite sides on the upper end of the base plate **26.** Vertical plates **137, 139** are mounted on opposite ends of the rod to facilitate horizontal movement of the rod by hand. Also mounted on the rod is a pointer **140** to indicate successive page numbers on a graduated scale **142** secured in the central area on the upper end of the base plate. At each end of the scale are additional fixed vertical plates **144, 146** which are used in cooperation with the plates **137, 139** on the slidable rod **131** to manually move the rod to the left or right to rapidly turn the rods and pages.

A control cable **148** is secured in a slot **150** under a screw **152** in a bracket **154** mounted on plate **139** so that the cable **148** moves back and forth with rod **131.** Cable **148** passes around idler pulleys **156, 158** secured on the baseplate and is fastened at the upper end of cam plate **78** by a hook **160** and screw **162.** The cable also passes in the other direction around idler pulley **164** at the upper end of the base plate to pulleys **166** and **168** at the lower end and connects to the lower end of cam plate **78** by a second hook **170** and screw **172.** The position of hook **170** is adjustable to maintain a desired tension in cable **148.** The page turning rods **24** may then be turned rapidly and continuously without the lever and pawl mechanisms by pushing rod **131** to the left or right.

Movement to the left is accomplished by grasping fixed vertical plate **146** and plate **139** on the right side of slidable rod **131** and firmly pushing plate **139** and rod **131** from right to left toward plate **146.** Cable **148** secured to plate **139** on rod **131** is thus likewise moved to the left and pulls cam plate **74** in the upward direction to move rollers **74** and bars **58** to the left and turn the driver pulleys, cables and rods to the left in rapid succession until all or a desired number of the pages are turned. By moving the fixed pointer **140** on rod **131** to a particular number setting on indicator **142** the continuous rotation of rods **24** may be stopped at a desired page number or position. Return movement from left to right is accomplished by grasping end plates **137** and **144** and pushing rod **131** to the right. Cable **148** is then pulled to the right and in turn pulls hook **170** and cam plate **74** downwardly, thus moving rollers **74** and bars **58** to the right while turning pulleys **34, 35,** cables **44, 46** and successive rods **24** and pages to the right. The control levers **120, 128** and pawl assembly mechanisms **96, 102** are thus bypassed with the bar **110** and spring **103** holding the pawls out of engagement with the teeth as cam plate **78** and rack **80** move up and down. The rapid turning mechanism may also be located at the lower end of the base plate if so desired.

In another variation, shown in FIGS. **12**a, **12**b and **12**c, the idler pulley **66** and cable tension adjuster bracket **68** may be replaced by an alternate self adjusting embodiment including an idler pulley **174** supported in a bracket **176** on one end of a rod **178.** The end of the cable **44, 46** from pulleys **34, 35** on rods **24** fits around idler pulley **174.** A plurality of rods **178** are slidably mounted within a plastic block **180** secured on base plate **26** behind the mid-section of bars **58.** At the other end of the rod **178** are a head **182,** a compression spring **184** around the rod and a locking washer **186** between the spring **184** and block **180.** Tension in the cable is then maintained by spring pressure against the head **182** of rod **178** with the other end of the spring pressing against washer **186.** The spring causes the washer to tilt at a slight angle to hold rod **178** in place against block **180.** Tension is thus maintained when

bars **58**, and the respective cables and page turning rods are moved in either direction.

The present invention thus provides an improved page turning mechanism which permits rapid turning of the pages in either direction by direct rotational coupling to the page holding rods. While only a limited number of embodiments have been described and illustrated, it is apparent that many other variations may be made in the particular design and configuration without departing from the scope of the invention as set forth in the appended claims.

What is claimed is:

1. A page turning device comprising

a base plate for supporting a publication having a plurality of pages;

a plurality of vertically disposed wire rods pivotally mounted on a central area of said base plate, each rod having opposite horizontally extending ends vertically spaced from each adjacent rod end;

a plurality of wire rod supports spaced along said rods on said base plate, each rod being rotatable about a separate vertical axis through said supports, a group of said wire rods being spaced horizontally in a common plane through said supports;

a plurality of vertically extending thin flexible page holding strips connected respectively between said opposite horizontally extending ends of each rod and engageable with the length of a page;

a plurality of pulleys coaxially secured respectively on each vertical rod for rotation therewith, each pulley being spaced in vertical steps along each respective rod from each adjacent pulley, each pulley of a group of said pulleys being spaced in successive horizontal steps on respective adjacent vertical rods in said group of rods;

a plurality of horizontally disposed vertically spaced wire cables secured respectively to each pulley;

rotatable support means for guiding each respective said cable in alternate directions along a looped horizontal path, the horizontal length of each said cable varying in steps in accordance with the distance between each said rotatable support means and each said pulley on each said rod in said group of pulleys and rods; and

control means for drawing said cables and rotating said horizontally and vertically spaced pulleys on respective rods successively in selective alternate directions so that each of said cables secured to each of said pulleys on each of said rods turns each of said rods and page holding strips from one side of said base plate to the other.

2. The device of claim **1** wherein said control means includes a plurality of vertically spaced horizontally slidable bars connected respectively to each cable to draw said cables in alternate directions along said horizontal path, a vertically slidable cam plate having a vertically disposed cam slot, said cam slot including upper and lower horizontally displaced vertical portions and a central connecting portion, coupling means on each said bar engaging said slot to cause horizontal movement of said bars upon vertical movement of said cam plate and slot, and means for moving said cam plate in selective alternate vertical directions, said cam slot moving said coupling means horizontally between said upper and lower portions and successively moving said bars in a corresponding horizontal direction, said bars drawing said cables to rotate said pulleys and turn said rods and page holding strips.

3. The device of claim **2** wherein said means for moving said cam plate includes a vertically disposed toothed rack secured along one side of said cam plate, a pair of opposing vertically disposed pawls positioned adjacent said rack for engagement therewith, means for normally holding said pawls out of engagement with said rack, and a pair of intermittently operable levers connected to respective said pawls, movement of the first said lever causing the first said pawl to engage a tooth of said rack to move said cam plate downwardly a predetermined fixed distance between adjacent teeth and move a respective bar and cable and turn a respective pulley and rod from left to right, movement of the second said lever causing the second said pawl to engage a tooth of said rack to move said cam plate upwardly said predetermined distance and move a respective bar and cable and turn a respective pulley and rod from right to left, successive movements of each lever engaging successive teeth and moving successive rods in a selective alternate direction.

4. The device of claim **3** wherein said means for moving said cam plate includes an additional rapid continuous turning mechanism having a control cable connected to opposite ends of said cam plate, a plurality of pulleys rotatably secured on said base plate for guiding said control cable, and a slidable rod connected to said control cable to draw said control cable and cam plate in selective alternate directions to successively move said bars and cables and turn the respective said pulleys and rods.

5. The device of claim **4** including means for indicating the number of rods in an intermediate turned position of said rapid turning mechanism.

6. The device of claim **3** wherein said coupling means includes rollers rotatably mounted on said bars.

7. The device of claim **3** wherein said rotatable support means includes a plurality of idler pulleys secured on said base plate and rotatably supporting each respective cable.

8. The device of claim **7** wherein said rods, pulleys on said rods, cables, bars and idler pulleys are arranged in two tier groups, one behind the other.

9. The device of claim **8** including means for limiting the movement of said levers to move said pawls said predetermined distance.

10. The device of claim **8** wherein said rod supports include means for limiting the vertical movement of said rods.

11. The device of claim **8** including a guide block having horizontal channels for said plurality of horizontal bars, a first vertical channel for said toothed rack, a second vertical channel for said pair of opposed pawls, and a vertical bar between said pawls and toothed rack and resilient means connected between said pawls to normally maintain said pawls out of engagement with said teeth.

12. The device of claim **8** including tension adjusting means connected to each said idler pulley for applying adjustable tension to each said cable secured to said pulleys on said rods.

* * * * *