United States Patent [19]

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[54] **AUTOMATIC LINE-UP TABLE**

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[52] **U.S. Cl.** **33/80**
[51] **Int. Cl.** **B43l 5/00**
[58] **Field of Search** ..... 33/1 M, 18 R, 23 C, 80

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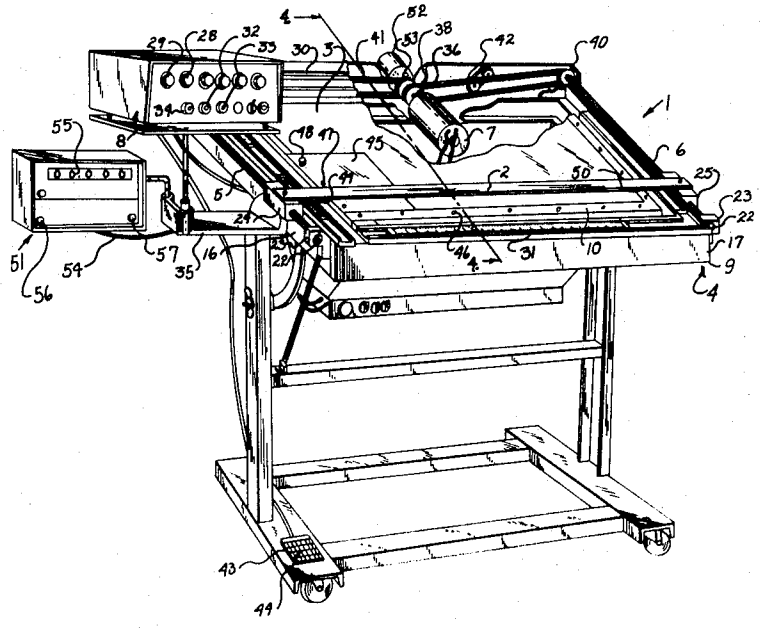
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Assistant Examiner—Charles E. Phillips
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[57] **ABSTRACT**

An automatic line-up table structure having a rectangular table top and a straight edge member which is operable thereover. The straight edge member has guide members operable in ways adjacent opposite side edges of said table top and the straight edge member has members operatively connected to moving members at said opposite side edges operable by an impulse stepping motor whereby activation of the motor moves the straight edge member. Controls for said motor include a micrometer indexing unit and circuitry therefor whereby the straight edge member is selectively moved in selected directions and in predetermined increments between accurate parallel positions for each impulse imparted to the motor.

5 Claims, 6 Drawing Figures



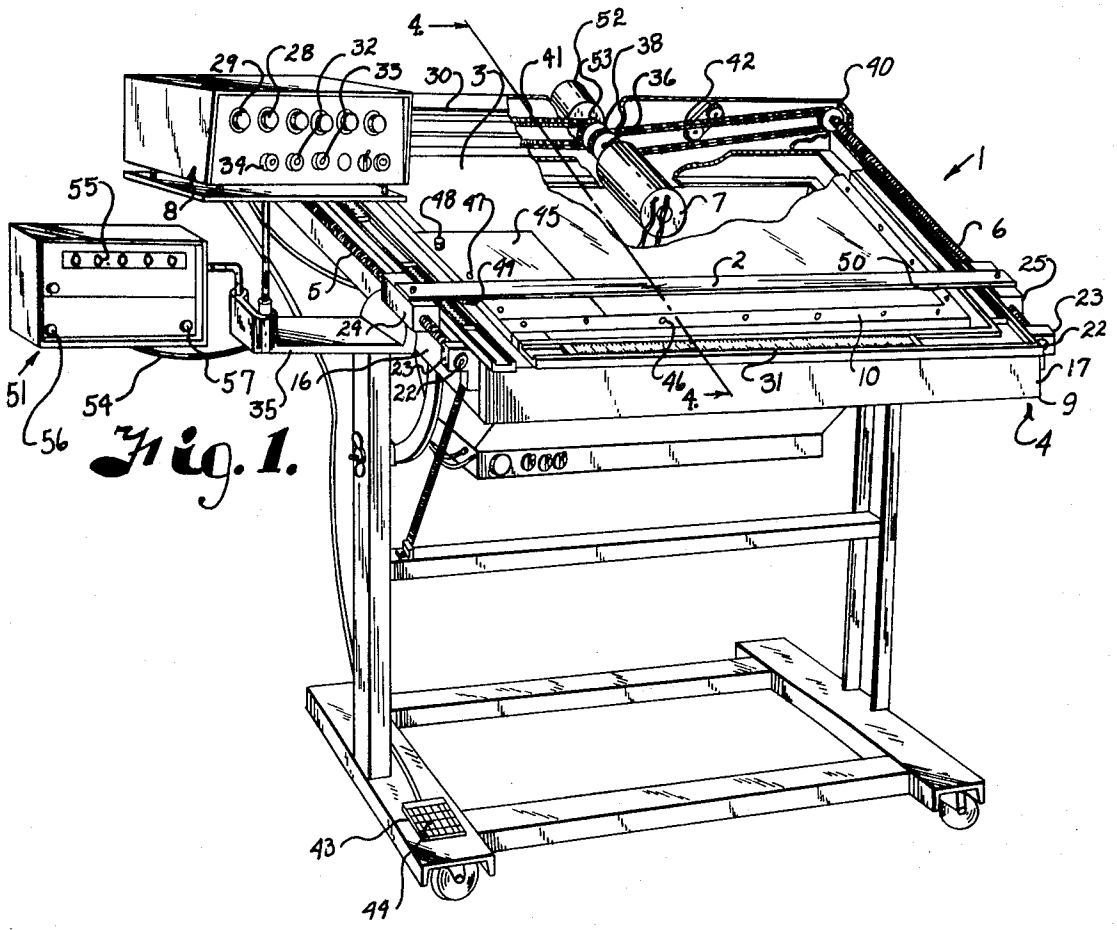


Fig. 1.

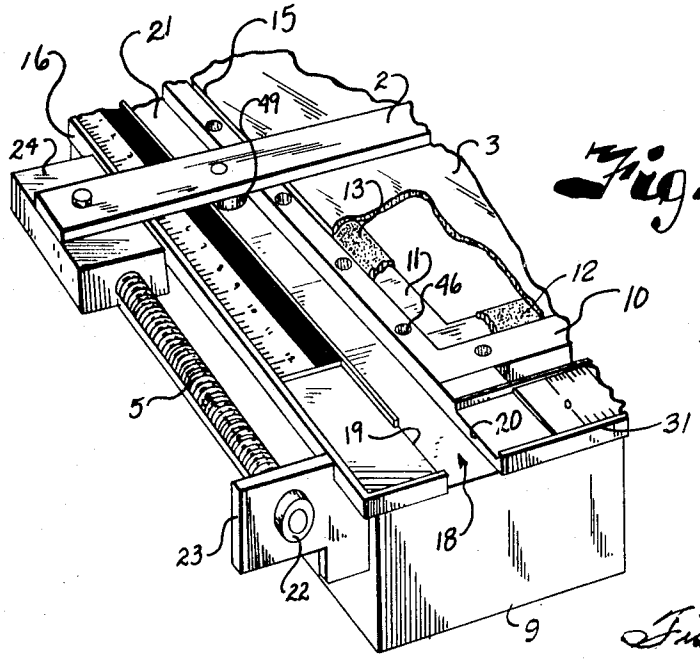


Fig. 2.

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Fig. 3.

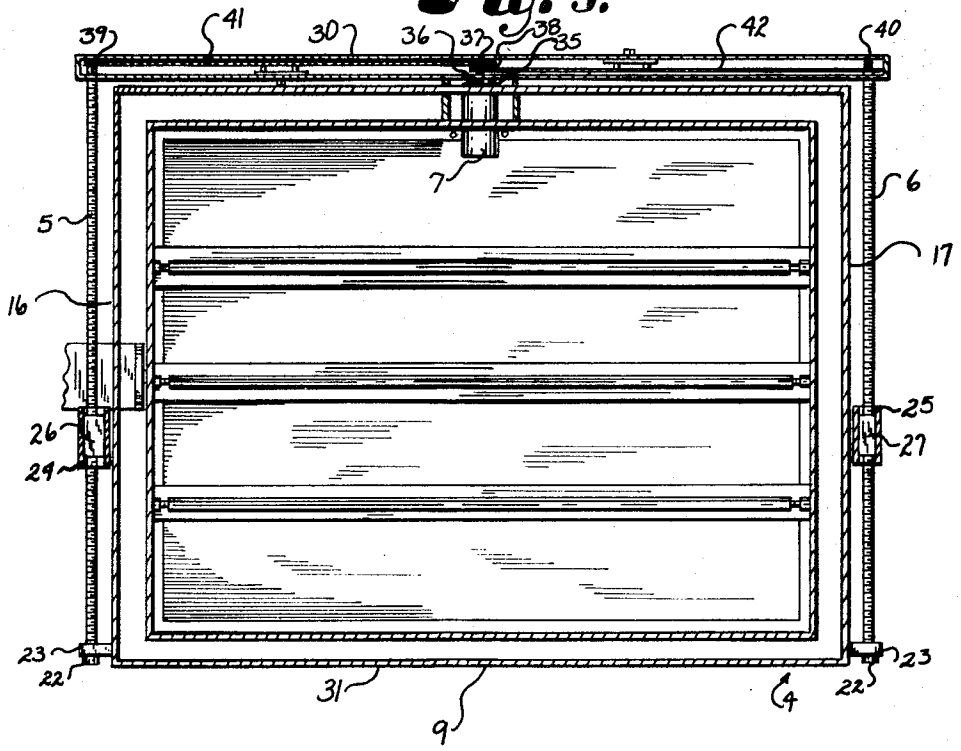
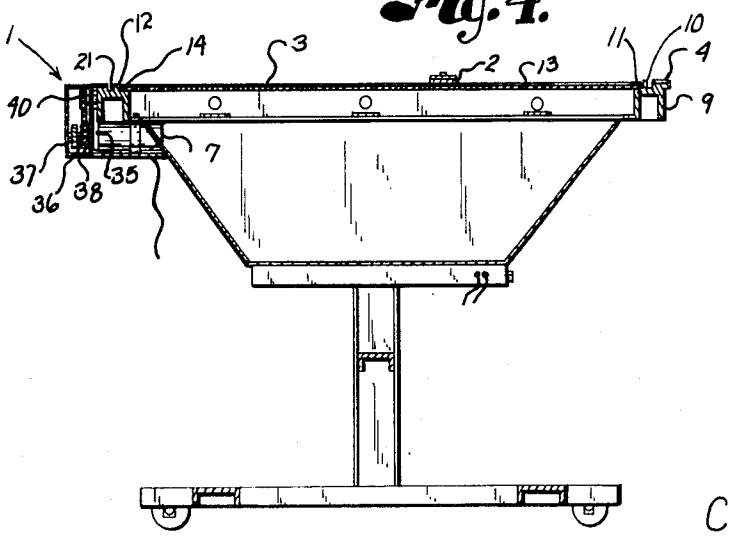


Fig. 4.



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Fig. 6.

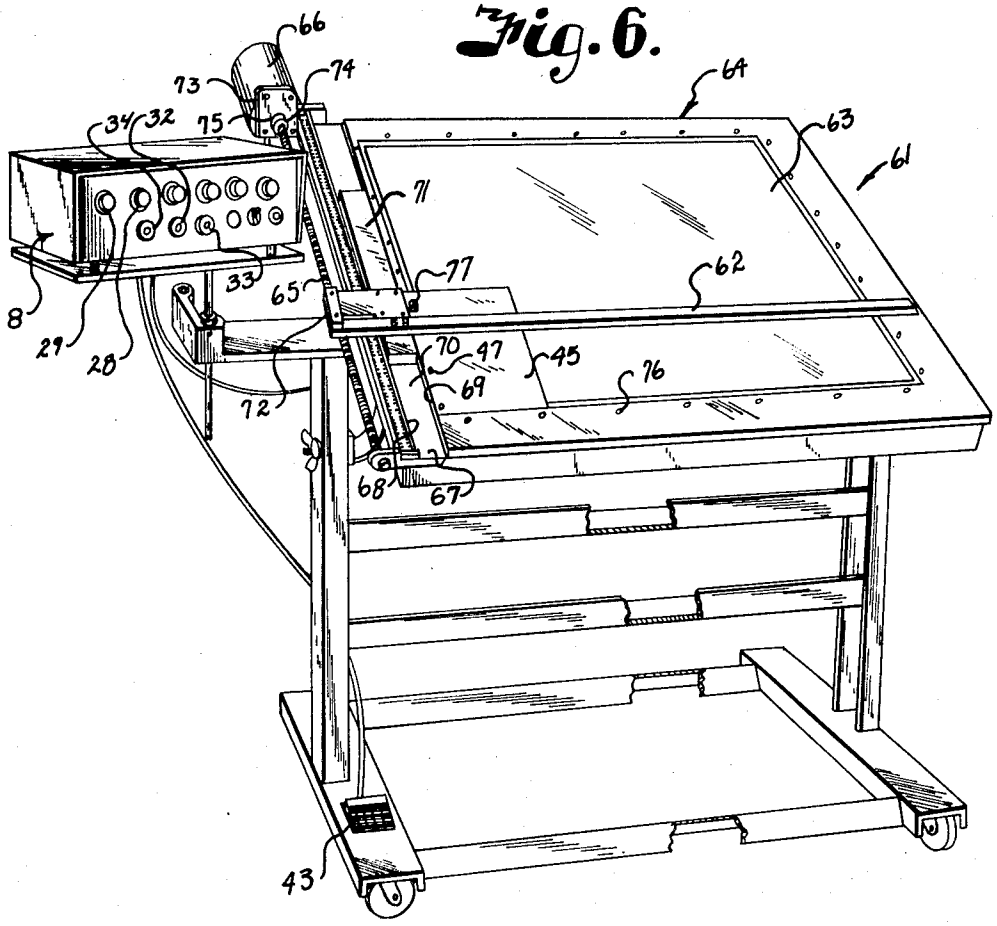
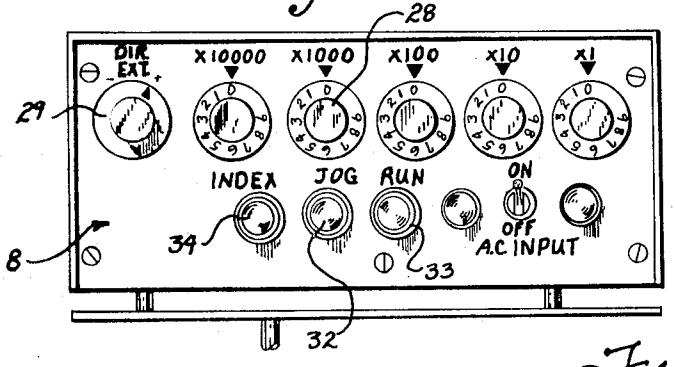


Fig. 5.



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AUTOMATIC LINE-UP TABLE

The present invention relates to tables used in the graphic arts industry and more particularly to such a table for drawing, laying-out materials for printed circuits, computer forms, and the like wherein designs, photographs and the like, are lined-up with a straight edge member being selectively movable over a work surface of the table to position such work.

The principal objects of the present invention are: to provide a line-up table for use preparing materials for printed circuits, computer forms, and the like; to provide such a line-up table having improved straight edge moving means for effecting movement of a straight edge member to a plurality of successive indexed parallel positions; to provide such a line-up table having an index control unit for selecting the direction and presetting the amount of movement of the straight edge member in response to each activation of the control unit; to provide such a line-up table having a plurality of register pins uniformly spaced along work surface edge portions to be received in correspondingly spaced and sized punched apertures in a work sheet thereby accurately positioning the work sheet on a portion of the table top; to provide such a line-up table having guide members mounted on the straight edge member and received within guide ways in the table top for eliminating end play or longitudinal movement of the straight edge member and for maintaining the straight edge member positioned immediately above the work surface; to provide such a line-up table with threaded shafts on opposite sides and a drive for rotating same in synchronism to move the straight edge member in parallel increments; to provide such a line-up table wherein the straight edge member accurately returns to selected positions; and to provide an accurate line-up table that is efficient in use, effective to obtain accuracy and speed in producing copy and lining-up and registering same thereon in the preparation of copy for reproduction operations, durable in construction and particularly well adapted for the proposed use.

Other objects and advantages of this invention will become apparent from the following description taken in connection with the accompanying drawings wherein are set forth by way of illustration and example certain embodiments of this invention.

FIG. 1 is a perspective view of a line-up table embodying features of the present invention.

FIG. 2 is an enlarged partial perspective view of one corner of the line-up table showing the operating members thereon.

FIG. 3 is a horizontal sectional view illustrating a driving mechanism for a straight edge moving mechanism.

FIG. 4 is a longitudinal sectional view through a table top frame and a straight edge member thereabove taken on line 4—4, FIG. 1.

FIG. 5 is an enlarged elevational view of an index control unit for selecting the direction and presetting the desired amount of lateral movement of the straight edge member.

FIG. 6 is a perspective view of a modified line-up table.

Referring more in detail to the drawings:

The reference numeral 1 generally designates a line-up or lay-out table having automatic means mounted thereon for moving a straight edge member 2 over a work surface 3 mounted within a table top frame 4 in response to operation of a pair of moving structures which in the illustrated structures are a pair of elongated threaded shafts 5 and 6 rotated by a motor 7 when activated by a control unit 8. The control unit 8 is operatively connected to the motor 7 and has adjustable means associated therewith for selecting the direction and in association with reduction mechanism the presetting of the desired amount of rotation of the threaded shafts 5 and 6 or movement of the straight edge member for each activation of the motor 7.

In the structure illustrated, the table top frame 4 is formed of a plurality of frame members 9 positioned at peripheral side edges of the table top frame 4 to define an opening therein, as later described. Each frame member 9 has an upper surface 10 and a shoulder 11 parallel with the upper surface 10 and positioned below and inwardly of an inner edge 12 of the upper surface 10 of each of the frame members 9. The inner edges 12 of the frame members 9 cooperate to define a cut-out or opening having the size and area of a desired work receiving space within the table top frame 4. The shoulders 11 each provide support for respective marginal edge portions of a translucent or photo-diffused panel of glass or other suitable material to define the work surface 3 whereby the panel is arranged in covering relation to the opening defined by the inner edges 12 of the upper surfaces 10 of the frame members 9. The panel overlies the shoulders 11 and preferably rests on strips of felt 13 or other suitable material positioned on the shoulders 11.

A wall 14 depends from the inner edge 12 of the upper surface 10 of each of the frame members 9 and forms an outer end of the respective shoulder 11. The wall 14 is preferably polished, ground or otherwise trimmed whereby adjacent walls 14 are perpendicular when the frame members 9 are joined to form the table top frame 4. An upper face or surface of the panel forming the work surface 3 is preferably a smooth flat surface with peripheral edges 15 preferably ground or otherwise trimmed whereby adjacent edges are perpendicular and spaced inwardly from the adjacent wall 14 of the respective frame member 9.

The frame members 9 at one pair of opposed ends or sides 16 and 17 of the table top frame 4 each have an elongated guide recess or way 18 therein and the way 18 is parallel with the respective threaded shafts 5 and 6 respectively. Each recess or way 18 extends the full length of the respective frame member 9 and has parallel facing walls 19 and 20 and a generally planar bottom wall 21 extending between lower edges of the facing walls 19 and 20. It is preferable that the facing walls 19 and 20 have a constant spacing therebetween and that the exposed surface of the bottom wall 21 have a smooth surface for movement of guide members within the respective way 18, as later described.

The elongated threaded shafts 5 and 6 are each rotatably mounted in parallel spaced relation with the way 18 in the frame members 9 at the respective opposed ends 16 and 17 of the table top frame 4. In the illustrated structure, opposite ends of each of the threaded shafts are rotatably supported in suitable bearings 22 mounted in support brackets 23 extending outwardly from the frame members 9 at the opposed ends 16 and 17. The support brackets 23 are positioned

adjacent opposite ends of the frame members 9 whereby the threaded shafts 5 and 6 extend substantially the full length of the adjacent frame member.

The straight edge member 2 is positioned above the table top frame 4 and extends between and is normal to the recesses or ways 18 in the frame members 9 at the opposite ends 16 and 17. The straight edge member 2 is also normal or perpendicular to the threaded shafts 5 and 6 and has guide housings 24 and 25 mounted on a lower surface adjacent each end thereof. The guide housings 24 and 25 each have walls defining a chamber therein with the shafts 5 and 6 respectively extending therethrough.

Internally threaded members 26 and 27 are mounted within the chamber of the guide housings 24 and 25 respectively and sleeved on the respective threaded shafts 5 and 6 which extend through the respective chamber. The shafts 5 and 6 are rotatably and threadedly engaged within the internally threaded members 26 and 27 respectively whereby rotation of the threaded shafts 5 and 6 moves the guide housings 24 and 25 longitudinally along the threaded shafts 5 and 6 thereby moving the straight edge member 2 over the work surface 3.

The motor 7 is an impulse stepping motor operatively connected to each of the threaded shafts 5 and 6 and to the control unit 8 which includes adjustable means to vary the duration of an impulse conveyed to the motor 7 thereby controlling the duration of operation of the motor 7 and the amount of movement of the straight edge member 2. It is preferable that the motor 7 be reversible and adapted to instantly start and to instantly stop in response to activation and termination of signals from the control unit 8.

Each impulse conveyed to the motor 7 is operative to rotate said motor a predetermined increment and the connection between the motor 7 and the shafts 5 and 6, as later described, is operative to move the straight edge member 2 in increments of one-thousandth of an inch.

The control unit 8 is adapted to be adjusted to select the direction and preset the desired amount of rotation of the threaded shafts 5 and 6 for each activation of the motor 7 by the control unit 8, as later described. The control unit 8 has a plurality of distance dials 28 adapted to control the amount of movement of the straight edge member 2 wherein the combined setting of the distance dials 28 controls the total amount of said movement by controlling the duration of impulses conveyed to the motor 7.

In the illustrated control unit, adjustment of a first distance dial 28 is adapted to set or determine the lowest unit of movement of the straight edge member 2, for example one-thousandth of an inch, and the next adjacent distance dial 28 is adapted to set or determine the amount of movement of the straight edge member in increments of one-hundredth of an inch. Adjustment of the next adjacent distance dial 28 controls increments of one-tenth of an inch and adjustment of an other dial 28 controls the amount of movement of the straight edge member 2 in one inch increments. The combined setting of the distance dials 28 controls the total duration of the impulses conveyed to the motor 7 thereby controlling the running time of the motor or the length of the time that the motor 7 is operative to turn or rotate the threaded shafts 5 and 6. The control unit 8 is thereby accurate to one-thousandth of an inch movement of the straight edge member 2 over the work surface 3.

Adjustment of a direction dial 29 is operative to select the direction of rotation of the threaded shafts 5 and 6 whereby the straight edge member 2 may be selectively moved toward an upper edge 30 of the table top frame 4 or toward a lower edge 31 of the table top frame when the motor 7 is activated.

The control unit 8 includes a jog pushbutton 32 which is operative to complete a circuit to effect moving of the straight edge member 2 in extremely short steps. The straight edge member 2 can be moved toward a desired beginning or index position in response to successive operations of the jog pushbutton 32. The control unit 8 also includes a run pushbutton 33 which is connected to a circuit adapted to operate the motor 7 continuously until the pushbutton 33 is released to thereby move the straight edge member 2 over the table top frame 4 relatively long distances, such as toward an index or starting point, with the final adjustment being made by successive operations of the jog pushbutton 32. The control unit 8 also includes an index pushbutton 34 which is operative to complete a circuit adapted to run the motor 7 the length of time necessary to move the straight edge member 2 the distance preset on the plurality of distance dials 28.

The motor 7 is mounted on a bracket 35 and is operative to rotate a shaft 36 extending therefrom and having a pair of driving members 37 and 38 mounted thereon and the driving members 37 and 38 are operatively connected to a pair of driven members 39 and 40 respectively which are fixedly mounted on the threaded shafts 5 and 6 respectively. Flexible power transmission members 41 and 42 extend between the driving and driven members for rotation of the threaded shafts 5 and 6 in response to signals from the control unit 8.

In the illustrated structure, the driving and driven members are sprockets and the power transmission members are chains with the chain 41 extending between the driving sprocket 37 on the motor driven shaft 36 and the driven sprocket 39 on the threaded shaft 5. The chain 42 extends between the driving sprocket 38 on the motor driven shaft 36 and the driven sprocket 40 on the threaded shaft 6.

The impulse stepping motor 7, the lead of the threads on the shafts 5 and 6, and the members connecting the motor 7 and the shafts 5 and 6 are operative to move the straight edge member 2 in increments of one-thousandth of an inch as set on the control unit 8.

It is desirable to provide an operator of the automatic line-up table 1 with means for energizing or activating the motor 7 without depressing the index pushbutton 34 by using one hand whereby the operator may have both hands free for the production of copy work, such as for printed circuits, computer forms and the like, therefore, a remote control device 43 is operatively connected to the control unit 8, as by a suitable electrical conductor. The remote control device 43 has a treadle or lever 44 normally held in a raised position by suitable resilient members, such as springs or the like (not shown), whereby depressing the treadle or lever 44, as by a foot, completes a circuit which conveys a signal to the motor 7 through the control unit 8.

it is desirable to use the line-up or lay-out table **1** in the preparation of copy for step and repeat operations, such as the preparation of computer forms, printed circuits and the like, therefore, fastening means are associated with the table top frame **4** to selectively hold a work sheet **45** in a position having a portion thereof overlying the work surface **3**, as defined by the translucent panel.

In the illustrated structure, a plurality of recessed bushings **46** are spaced around the work surface **3** and the recessed bushings **46** are positioned in the upper surface **10** of the frame members **9** and are positioned adjacent the inner edge **12** of the respective frame members **9**. The recessed bushings **46** are aligned and spaced to correspond and register with punched apertures **47** in the work sheet **45**.

A plurality of register pins **48** are provided and each are adapted to be mounted in the recessed bushings **46** to hold the work sheet **45** in a selected position. The pins **48** each have a shank or shaft portion sized and shaped to pass through a respective one of the punched apertures **47** in the work sheet **45** and to be secured within a respective recessed bushing **46** and the pins **48** each have a head portion adapted to engage an upper surface of the work sheet **45** thereby selectively fastening the work sheet to a portion of the table top frame **4**.

Guide members **49** and **50** are mounted on and depend from a lower surface of the straight edge member **2** and are received within the recess or way **18** in the frame members **9** at the end edges **16** and **17** respectively. The guide members **49** and **50** mounted on the straight edge member **2** are movable along the respective recess or way **18** for maintaining the straight edge member and have rollers (not shown) **2** immediately above the work surface **3**, as defined by the translucent panel.

The rollers of the guide members **49** and **50** are mounted in suitable housings which are sized to slidably engage the facing surfaces of the facing walls **19** and **20** during movement of the straight edge member **2** over the table top frame **4** and the work surface **3**. The engagement of the housings with the facing surfaces of the walls **19** and **20** maintains the straight edge member **2** normal to the respective way **18** and the engagement of the rollers with the bottom wall **21** maintains the straight edge member **2** above the work surface **3** whereby the straight edge member **2** is movable to a plurality of successive parallel positions.

In using the line-up or lay-out table **1** constructed as illustrated and described, a work sheet **45** is preferably punched in a punching apparatus having extremely high accuracy and repeatability for forming the punched apertures **47** in the work sheet **45**. The work sheet **45** is pin registered to the table top frame **4** with the pins **48** and that portion of the copy or work sheet **45** over the work surface **3** is suitably secured, as with tape. The pin or pins **48** toward which the straight edge member **2** will be moving are then removed. All the distance dials **28** are set to zero and then moved to the respective settings corresponding to the required distance in inches and thousandths for successive movements of the straight edge member **2** which is then precisely positioned at a selected index or reference point on the work sheet **45** in response to operation of the jog and run pushbuttons **32** and **33**. The successive movements of the straight edge member **2** may be accomplished by depressing the index pushbutton **34** or by depressing the treadle or lever **44** of the remote control device **43**. A suitable scribing tool (not shown) is moved along the straight edge member **2** at each location to mark or scribe the work sheet **45**. After all the successive parallel lines have been marked on the work sheet **45**, the work sheet **45** may be removed and turned 90° and again pin register and secured in position over the work surface **3**. Lines normal to those previously placed on the work sheet **45** are marked or scribed in a similar manner using the pushbuttons of the control unit **8** or the treadle or lever **44** of the remote control device **43**.

It is important to note that impulse stepping motors are characterized by the fact that the motor is locked in position between impulses therefore, the shaft **36** and the threaded shafts **5** and **6** are each locked in position at the end of each run of the motor **7** and are locked in position when the motor **7** is inoperative. It is also noted that the threaded shafts **5** and **6** may be turned only by operation of the motor **7** whereby the straight edge member **2** is securely held in position for supporting the selected scribing tool during movement thereof along the straight edge member **2** for marking the work sheet **45**. It is also important to note that the threaded shafts **5** and **6** and the internally threaded members **26** and **27** are each accurately machined for firm interengagement with substantially no play between the threaded shafts and the internally threaded members.

A digital display unit **51** may be operatively connected to the motor **7** to display numerical valves representing the collective increments or total linear movement of the straight edge member **2** in one or both directions over the work surface **3** whereby an operator may accurately observe numerical valves representing the position and movement of the straight edge member **2**.

A rotary pulse generator **52** is synchronized with the motor **7** and in the illustrated structure, the generator is mounted on the bracket **35** and is positioned in axial alignment with and operatively connected to the motor **7**, as by directly coupling the shaft **36** of the motor **7** to a shaft **53** of the generator **52**. The generator **52** is particularly adapted to convert rotary motion or analog information to digital information in the form of precise electrical pulses to drive electronic counters or controllers, such as the digital display unit **51** by means of the electrical pulses conveyed through an electrical conductor **54**.

The digital display unit **51** is an electronic totalizing counter which is operative to count the pulses generated by the generator **52** and visually display a numerical valve representing the total thereof or a numerical valve corresponding to the total linear measurement of movement and the illustrated display unit **51** has a plurality of in line illuminated display members **55** operative to visually display numerical valves in inches, tenths, hundredths, and thousandths of an inch corresponding to rotation of the motor **7** and shafts **5** and **6** to thereby represent total linear movement of the straight edge member **2** over the work surface **3**.

The display unit **51** has a control switch **56** electrically connected to a suitable source of current and operative to complete a circuit to control circuits (not

shown) within the display unit **51**. Turning the control switch **56** to an "off" position clears the display members **55** or returns the reading to zero. However, it is preferable to clear the reading without turning off the power to the display unit **51**, therefore, a push button switch **57** is operatively connected to the operative circuits within the display unit **51** and depressing the push button switch **57** is operative to clear the display members **55** without interrupting the electrical connection to the source of power.

FIG. **6** illustrates a modified line-up or lay-out table **61** and a modified straight edge member **62** movable over a work surface **63** mounted within a table top frame **64** in response to rotation of an elongated threaded shaft **65** by a motor **66** when activated by the control unit **8** or the remote control device **43**.

The table top frame **64** at one end of one of a pair of opposed ends has an elongated recess or way **67** therein and the way or recess **67** is parallel with the threaded shaft **65** and normal to the straight edge member **62**. The way or recess **67** extends the full length of the respective end of the table top frame **64** and has parallel facing walls **68** and **69** and a generally planar bottom wall **70** extending between lower edges of the facing walls **68** and **69**.

An elongated planar guide bar **71** is secured on the straight edge member **62** in engagement with a lower surface thereof and the guide bar **71** is received in the recess or way **67**. The guide bar **71** preferably has opposite edges accurately finished or machined to provide firm slideable engagement with the surfaces of the facing walls **68** and **69**.

A guide housing **72** is mounted on one end of the straight edge member **62** and has an internally threaded member therein sleeved on the threaded shaft **65** for longitudinal movement therealong in response to operation of the motor **66** to rotate the threaded shaft **65**.

In the illustrated structure, the motor **66** is mounted on a bracket **73** positioned adjacent one end of the threaded shaft **65** and a suitable coupling **74** connects a motor driven shaft **75** to the threaded shaft **65** whereby operation of the motor **66** by the control unit **8** or the remote control device **43**, rotates the threaded shaft **65**. It is preferable that the motor **66** also be an impulse stepping motor and be of an electric reversible type adapted to instantly start and to instantly stop in response to activation or termination of an impulse signal from the control unit **8**.

It is desirable to provide the modified line-up or lay-out table **61** with fastening means for selectively holding a work sheet in a position having a portion thereof overlying the work surface **63**, therefore, a plurality of recessed bushings **76** are spaced around the work surface **63**. The recessed bushings **76** are aligned and spaced to correspond and register with the punched apertures **47** in the work sheet **45**.

A plurality of register pins are threadedly mounted in the recessed bushings **76** and the pins **77** are adapted to be raised by a suitable tool, such as a screw driver, to a position above an upper surface of the table top frame **64** whereby the work sheet **45** may be held in position by placing the punched apertures **47** over the raised pins **77**.

Operation of the modified line-up or lay-out table **61** is substantially similar to operation of the line-up or lay-out table **1**, except that the straight edge member **62** has a free end.

It is to be understood that while I have illustrated and described certain forms of my invention, it is not to be limited to these specific forms or arrangement of parts herein described and shown.

What I claim and desire to secure by Letters Patent is:

1. A line up table comprising:

a. a generally rectangular table top frame having a planar work surface and a pair of opposed end edges,

b. an elongate straight edge member above said table top planar work surface and frame,

c. a guide housing mounted on each end of said straight edge member in supporting relation thereto, each guide housing having walls defining a chamber therein,

d. an elongate threaded shaft rotatably mounted adjacent each end edge of one pair of opposed end edges of said table top frame, said shafts being parallel, each said threaded shaft extending through the chamber in a respective guide housing, said shafts each being normal to said straight edge member,

e. an internally threaded member mounted within the chamber of each of said guide housings and sleeved on said respective threaded shafts extending through said chamber, said respective threaded shafts being rotatably engaged within said respective internally threaded members to move same longitudinally of said shafts,

f. an impulse stepping motor and power transmission means carried by said table top frame and operatively connecting said stepping motor to each of said threaded shafts for simultaneously and equally rotating same to move said guide housings and thereby moving said straight edge member over said work surface, and

g. Control means mounted adjacent to said table and including a control unit having adjustable means to vary the number of pulses imparted to said stepping motor thereby controlling the number of incremental rotations of said motor and hence the number of incremental rotations of said threaded shaft and thereby controlling the amount of linear movement of said straight edge member over said table top.

h. recessed guideways in an upper surface of said table top frame adjacent each side edge of said one pair of opposed side edges thereof to define the path of movement of said straight edge member, each guideway being parallel with a respective threaded shaft,

i. a guide member mounted on said straight edge member adjacent to and spaced from from said guide housing at each end edge thereof and received in a respective guideway, said guide members having sliding engagement with said guideways and cooperating with the guide housings, threaded members therein and the elongate threaded shafts to maintain position to position parallelism of said straight edge member.

2. A line up table as set forth in claim **1** including:

a. an electronic counting means synchronized with said impulse stepping motor for converting rotation of said motor to digital information in the form of precise electrical pulses, and

b. means electrically connected to said electronic counting means to visually display numerical values representing total increments of linear movement of said straight edge member over said table top.

3. A line up table as set forth in claim 1 including:

a. a plurality of recessed bushings spaced around all sides of the work surface in said table top frame, said bushings being in an upper surface of said table top frame and spaced to correspond to and register with punched apertures in a copy sheet; and

b. a plurality of pins each sized and shaped to pass through the punched apertures in the copy sheet, said pins each having a portion sized and shaped to be received in said recessed bushings thereby selectively positioning the copy sheet to a portion of said table top frame, said pins to be removable when said copy sheet is fastened to said table top.

4. A line-up table as set forth in claim 1 including:

a. a rotary pulse generator synchronized with said impulse stepping motor and operative to generate digital information in the form of precise electrical pulses in response to operation of said impulse stepping motor, and

b. an electronic totalizing counter electrically connected to said rotary pulse generator and operative to visually display numerical values representing the total amount of movement of said straight edge member over said table top frame.

5. A line-up table as set forth in claim 4 including means electrically connected to said electronic totalizing counter for selectively clearing the numerical display of values representing the total amount of movement of said straight edge member to thereby permit said electronic totalizing counter to start a new collection of electrical pulses and display values representing a new total amount of movement of said straight edge member.

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