June 28, 1960 C. N. BREWER ET AL 2,942,351

MICROMETER DEVICE FOR OPERATING THE MOVABLE STRAIGHTEDGE OF A LINE-UP TABLE, AND THE LIKE

Filed Aug. 8, 1957 2 Sheets-Sheet 1

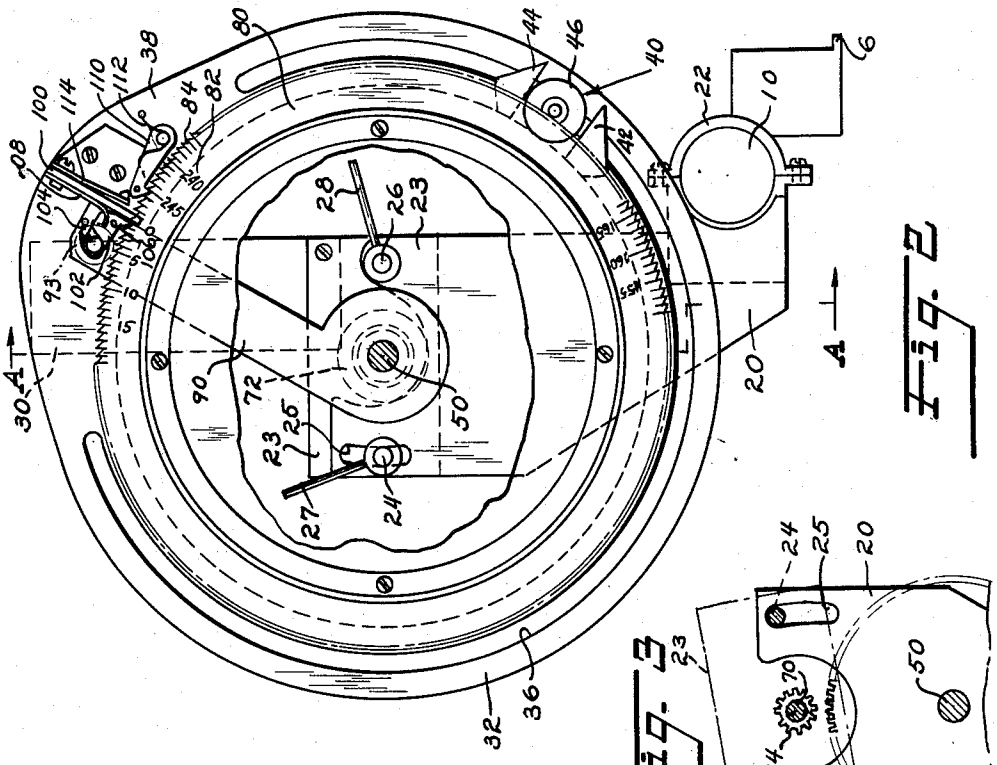


Fig. 2

Fig. 3

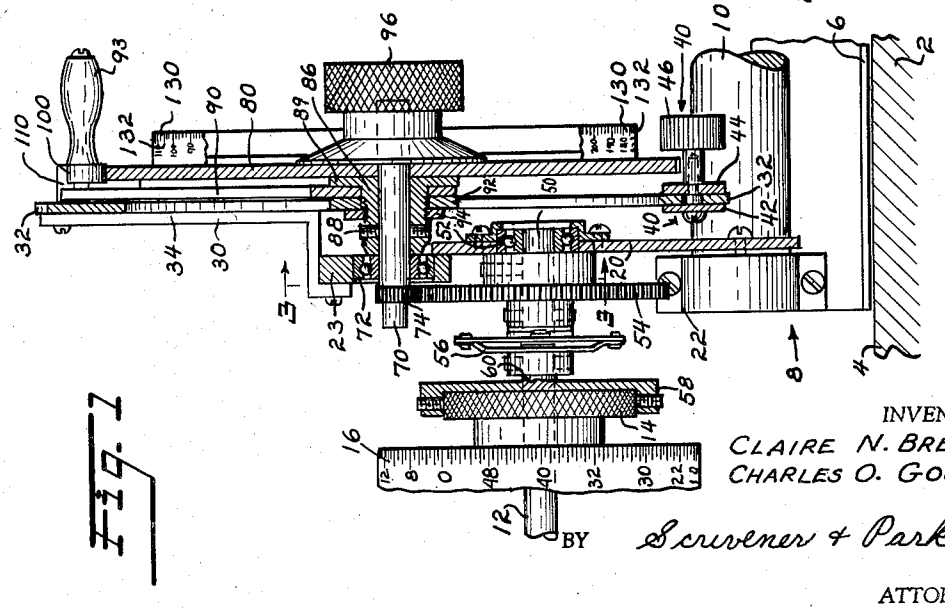


Fig. 1

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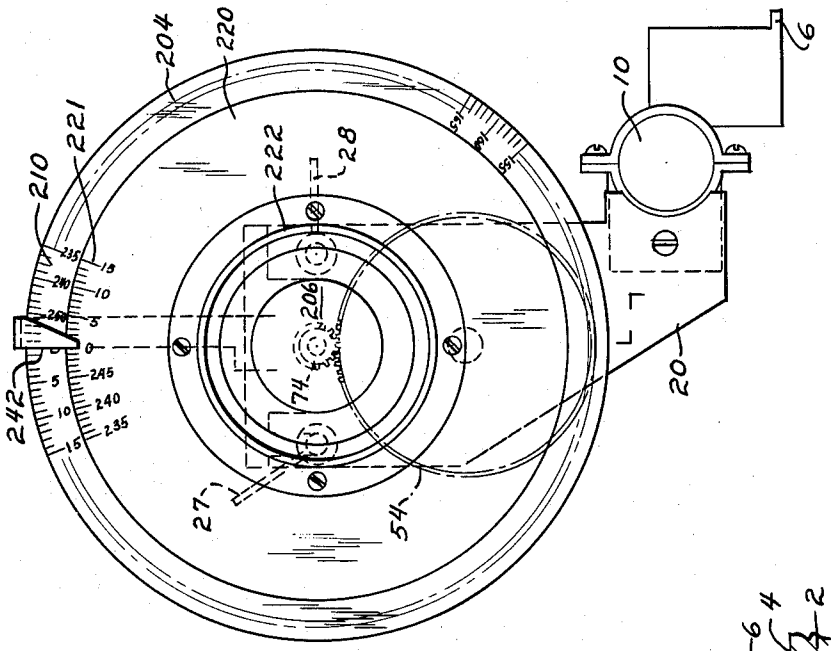


FIG. 5

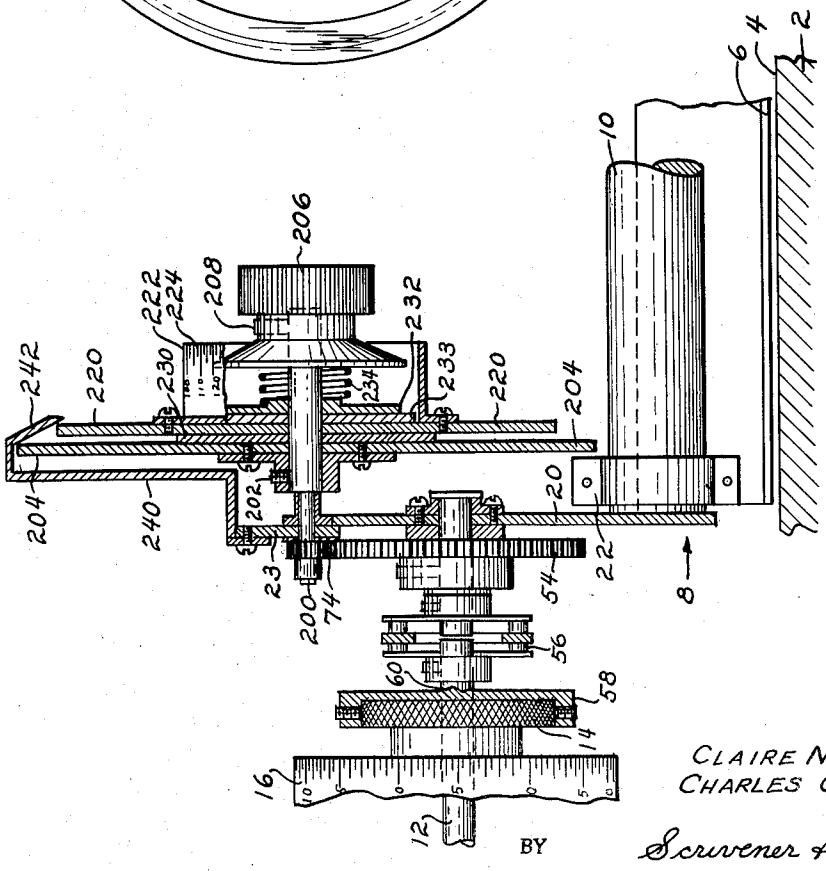


FIG. 4

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United States Patent Office 2,942,351
Patented June 28, 1960

2,942,351

MICROMETER DEVICE FOR OPERATING THE MOVABLE STRAIGHTEDGE OF A LINE-UP TABLE AND THE LIKE

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Filed Aug. 8, 1957, Ser. No. 677,001

5 Claims. (Cl. 33—184.5)

This invention relates broadly to the printing art and, more particularly, relates to so-called "line-up" or "register" tables which are used in performing such make-up operations as lining, ruling, scoring negatives and the like.

In United States Letters Patent Nos. 2,252,535 and 2,421,686 there are disclosed line-up tables of the type to which the invention relates and with respect to which this invention constitutes an improvement. In these tables there is provided a straightedge which is mounted for movement from end to end of the work surface of the table and which is used in drawing parallel lines extending transversely of the sheet of paper or other material laid on the work surface. Because of the requirements of the printing art the spacing of the lines made with the straightedge is of extreme importance and must be accurate to very close tolerances which are measured in thousandths of an inch. In line-up tables now known to the art the straightedge is moved by rotating a shaft through a vernier adjustment causing operation of the means which moves the straight edge. It has been found that this known means for moving the straightedge may not be operated to produce the very fine and accurate adjustment of the straightedge to thousandths of an inch, as is required for such purposes as compensation for expansion or shrinkage of the plates from which the lined paper or the material is printed.

Our invention has to do with the operation of the straightedge of line-up tables of the type and construction described and has had for its principal object the provision of means for operating the straightedge through increments, and to the accuracy, of thousandths of an inch, and for successively moving the straightedge through exactly the same distance with rapidity and unvarying and absolute accuracy for any number of successive times, thus greatly improving the usefulness of such tables and simplifying their operation.

The invention is described in the following specification and is illustrated in the accompanying drawings, in which:

Fig. 1 is a cross-sectional view taken on line A—A of Figure 2, showing the device in operative relation to parts of a line-up table;

Fig. 2 is a front elevational view of a device according to the invention with parts broken away;

Fig. 3 is a view taken on line 3—3 of Fig. 1, showing the parts of the frame in closed, gear-engaged position in full lines and in open, gear-disengaged position in broken lines, and

Figs. 4 and 5 are views which correspond to Figs. 1 and 2 but show a second embodiment of the invention.

This invention provides means for operating the movable carriage of a line-up machine of the type, construction and purpose described in the Letters Patent referred to hereinbefore, and which machines are now commercially available. Parts of such a machine are shown

in Fig. 1 of the drawings and comprise a work table 2, having a flat upper surface 4 on which a paper, mat or other device or sheet is to be laid for the purpose of drawing thereon a plurality of parallel lines equally spaced apart by a distance which must be exact to the thousandth of an inch. The straightedge 6 against which the lines are drawn forms part of a carriage 8 which is mounted for movement along the table and which also includes a shaft 10 which is adjacent the straight edge and parallel to it. The carriage is moved along the table by suitable and known means, such as a rack and pinion device, and such movement may be effected by rotating a shaft 12, to one end of which is attached a knob 14. Vernier devices 16 are usually provided for adjusting the amount of movement of the carriage. It will be understood that the shaft 12, knob 14, verniers 16 and the parts operated thereby are mounted on the carriage and move with it along the work surface. As stated, the operation of the carriage by means of the knob 14 and shaft 12, with the use of the vernier devices 16, cannot be performed with the required accuracy, but permit only the accurate movement of the carriage to ten thousandths of an inch. In a typical line-up machine one complete rotation of knob 14 and shaft 12 produces a two inch movement of the carriage 8 and a straightedge 6 along the work surface of the table and the invention will be described in this specification as applied to such a table, although it will be understood that the invention is not limited to any specific relation between a complete rotation of the shaft and knob and the distance of movement of the carriage along the work surface.

Means are provided by the invention for quickly and accurately moving the straightedge 6 and other parts of the carriage any number of successive times through any desired distance and with accuracy to the thousandth of an inch. In the embodiments of the invention disclosed in this specification there is provided a two-part frame, one part of which is formed by a lower plate 20 having attached thereto a fitting 22 which surrounds and is fastened to the shaft 10 of the carriage 8, whereby the device provided by the invention is mounted on the carriage and moves therewith. The second part of the frame is formed by an upper plate 23 which is pivotally connected at its one side, as at 26, to one side of plate 20 adjacent the upper part thereof. Adjacent its other side the plate 20 is provided with an elongated, curved slot or recess 25 having closed ends, which receives a pin or screw 24 which is mounted on plate 23. Clamping means, having handles 27, 28, are associated with the pins 24, 26 for locking the plate 23 in open or closed position with respect to plate 20. A bracket 30 is attached to the upper frame part 23 and extends upwardly therefrom and, at its upper end, supports a flat annular member 32 having a central opening 34 and provided with an arcuate slot or passage 36 which extends through a large arc which may be 360° or less and which, in the disclosed embodiment, is approximately 300°, leaving an unslotted part 38 between the ends of the slot. A stop device 40 is mounted on the annular member 32 and comprises parts 42, 44 which are disposed on opposite sides of the flat annular member and are connected by a screw device extending through the slot 36 and having an operating knob 46 by which the parts of the stop device may be loosened to permit the stop device to be moved along the annular member 32 to any desired position after which the knob may be operated to tighten the parts of the stop device and thus attach it to the annular member in the desired position.

A shaft 50 is rotatably journaled in the lower plate 20 of the frame and may be mounted in a ball bearing

race 52 in any suitable and known manner. A relatively large gear 54 having external gear teeth on its periphery is fixedly attached to shaft 50 for rotation therewith. The shaft 50 is preferably axially aligned with the operating shaft 12 of the line-up table carriage and is connected thereto by a coupling 56 which prevents binding when the shaft 12 is rotated by the gear 54 and shaft 50, and an adapter device 58 is attached to the knob 14 and has a shaft 60 which is attached to one side of the coupling device 56.

A second shaft 70 is journaled in the upper frame part 23 in ball bearing 72 and is parallel to, and spaced from, shaft 50. A gear 74, which is small relatively to gear 54, is fixed to shaft 70 and has external teeth which mesh with those of gear 54 when the frame parts 20, 23 are in closed position. Also fixed to shaft 70 is a circular dial or disc 80 which has an annular series of graduations 82 on its outer surface adjacent its periphery and the outer peripheral surface of which is provided with inclined ratchet teeth 84 which correspond in number and position to the graduations of scale 82. Between the gear 74 and the dial 80 a sleeve or bushing 86 surrounds the shaft 70 and is fixed to it by setscrews 88. The sleeve has an outwardly extending flange 89 at one end thereof which bears on the rear surface of dial 80. Adjacent the flange 89 the exterior surface of the sleeve is smooth and a radially extending arm 90 is rotatably mounted on this smooth surface. Adjacent this smooth surface the exterior surface of the sleeve is threaded to receive a washer 92, which confines the radial arm 90, and also to receive a lock nut 94 which holds the washer 92 in place. The sleeve 86 terminates adjacent the bearing 72 in which the shaft 70 is journaled. A knob 96 is attached to the end of shaft 70 outside, and in front of, the dial 80 and provides means for rotating shaft 70, dial 80 and gear 74.

The arm 90 is behind the dial 80 and is mounted on the sleeve 86 for rotation with respect to the dial and is sufficiently long that it extends beyond the periphery of the dial. A fixed stop member 100 is attached to the front surface of the annular member 32 at the part 38 thereof between the ends of the arcuate slot 36 and preferably takes the form of a plate extending outwardly at right angles to the member 32 and radially of the dial 80 and being sufficiently long that its inner end overlies the annular series of graduations 82 on the dial and has an aperture therein through which the peripheral edge of the dial passes. This stop member limits the movement of arm 90 in a clockwise direction. On the outer surface of its outer end part, which is outside the periphery of the dial, the arm is provided with an operating handle 93, and on this same surface of the arm and also outside the periphery of the dial a pawl 102 is pivotally mounted and has its point positioned to engage the ratchet teeth 84 on the dial, the pawl being so mounted that its point rides over the ratchet teeth when the arm 90 is moved in a counterclockwise direction. A spring 104 constantly urges the point of the pawl into engagement with the ratchet teeth. A pin 106 is mounted on the front surface of pawl 102 and when the arm is in position engaging the stop member 100 this pin is normally below and outside the lower, curved end of a J-shaped spring 108, the flat arm of which is attached to one side of the stop member 100. The pin 106 and the J-shaped member are so positioned with respect to each other that the pawl may, if desired, be moved about its pivot to engage the pin above the curved arm of the J-shaped member, thus locking the pawl in raised position with its point out of engagement with the ratchet teeth on the dial. On the opposite side of stop member 100 from the J-shaped member 108 a second pawl 110 is pivotally mounted on the part 38 of the annular member 32 which lies between the ends of the arcuate slot 36, and the point of this pawl is constantly urged into engagement with the ratchet teeth on dial 80 by a spring 112. This pawl is so mounted that it is directed oppositely to pawl 102 and its point therefore rides over the ratchet teeth when the dial is moved in a clockwise direction. A flat resilient member 114 is mounted on the side of stop member 100 adjacent pawl 110 and on its lower end has an enlarged detent part which may be engaged under the point end of the pawl to hold the same out of engagement with the ratchet teeth when this is desired or necessary in the operation of the micrometer device.

An annular cylindrical member 130 is mounted on the outer face of dial 80 concentrically with the dial and has an outer cylindrical surface 132 on which there is marked a series of graduations which corresponds to the series 82 on the peripheral face of the disc, thus permitting the graduations to be observed from the front of the disc or from above.

As stated, the operating means for the carriage and straightedge of the line-up table may be so constructed that one complete revolution of the operating shaft 12 produces a two-inch movement of the carriage and straightedge. If this relationship exists, the operating device provided by the present invention may, if desired, be constructed in the following manner. The relatively large gear 54 may have eight times the number of teeth of the relatively small gear 74 and, in a preferred embodiment, the larger gear will have 96 teeth and the smaller gear will have 12 teeth. The periphery of disc 80 will have 250 ratchet teeth and the series of graduations 82, as well as the series on cylindrical surface 132, will be divided into 250 equal divisions, each corresponding to one of the ratchet teeth. It will be seen that the following relations will result from these specifications:

1 rotation of shaft 12 causes 2 inches of carriage movement
1 rotation of dial 80 causes 1 rotation of small gear 74
1 rotation of dial 80 causes ⅛ rotation of large gear 54
8 rotations of dial 80 cause 1 rotation of large gear 54
8 rotations of dial 80 cause 2 inches of carriage movement
4 rotations of dial 80 cause 1 inch of carriage movement
1000 dial division movements cause 1 inch of carriage movement
1 dial division movement causes .001 inch of carriage movement

In the use and operation of a device according to the invention and having the specifications set forth above it will be assumed that it is desired to move the carriage 8 and straightedge 6 through successive movements of .160 inch each along the work surface of the line-up table. The micrometer device is first operatively disengaged from the shaft 12 of the carriage 8 of the work table in order to permit the initial positioning of the carriage. This is done by operating the handles 27, 28 to loosen the clamps which hold the plates 20, 23 in closed position, thus permitting the plate 23 to be moved about its pivotal connection to plate 20 to separate the gears 54, 74, after which the handles may again be operated to clamp the frame parts in separated position in which the gears are disengaged. The carriage 8 is now free to move to any position on the work table and is initially moved to any desired position, such as one end of the table, from which it is to be successively moved through equal distances, which in the present example are each .160 inch, to permit a series of parallel lines to be drawn. If desired, the carriage may be released for movement along the work table by holding the pawls 102, 110 out of engagement with the ratchet teeth 84 on dial 80 by the means described above, while leaving the gears 54, 74 in mesh, although it is preferred to release the carriage by disengaging the gears.

When the carriage has been positioned over the work surface with the straightedge in its proper initial position the dial 80 is rotated until the zero mark of the series of graduations 82 is opposite the indicating edge

of the stop and indicator member **100**. The arm **90** is now moved in a counterclockwise direction until the point of pawl **102** engages the ratchet tooth at the 160 mark on the scale **82**, and the stop device **40** is then moved along the slot **36** until it engages the rear edge of arm **90** and the stop is fixed in this position. None of these operations causes any rotation of the large gear **54** or the operating shaft **12** of the line-up table as the gear **74** has been moved out of mesh with the gear **54** by separation of the frame parts in the manner described. The gear **74** is now meshed with gear **54** by moving frame part **23** back into closed position with frame part **20** and locking the parts in this closed position by manipulation of the handles **27, 28**. The arm **90** is now moved in a clockwise direction from its position at the stop device **40** until it engages and is stopped by the fixed stop **100**. In so moving, the pawl **102** on the arm will engage the ratchet tooth at the 160 mark on the dial scale **82** and will rotate the dial in a clockwise direction with the arm until the arm is stopped by the fixed stop **100**. The dial **80** will therefore be moved through 160 divisions and will cause the small gear **74**, large gear **54** and shaft **12** to be rotated, thus moving the carriage **8** and straightedge **6** of the line-up table .160 inch in accordance with the relations set forth above. The arm **90** may be moved back and forth between the stops **40** and **100** any number of times and the clockwise part of each such movement will produce a .160 inch movement of the carriage and straightedge of the line-up table while the counterclockwise part of such movement will not produce any movement of the dial **80**, gears **54, 74**, shaft **12** or carriage **8** as the pawl **102** will ride over the ratchet teeth on the dial during such movement. If a different distance of movement of the carriage and straightedge is desired it is only necessary to adjust the stop device **40**.

A second embodiment of the invention is disclosed in Figs. 4 and 5 of the drawings and it will be seen that many of the parts are the same as those of the embodiment disclosed in Figs. 1 and 2 and need not be described further. These corresponding parts, which are similarly numbered, include the work table **2**, work surface **4**, carriage **8**, straightedge **6**, shaft **10**, carriage operating shaft **12**, knob **14**, verniers **16**, coupling **56**, fitting **22**, pivotally connected frame parts **20, 23**, large gear **54** and small gear **74**.

In this embodiment of the invention the small gear **74** is fixed to a shaft **200** which is rotatably journaled in pivoted frame part **23**. This shaft has fixed to it by screws **202** a relatively larger dial or disc **204** and a knob **206** which is attached to the shaft by a setscrew **208**. Dial **204** has an annular series of graduations **210** on its outer face adjacent its periphery and, in the disclosed embodiment and with the specifications and relation of parts described above in connection with the embodiment of Figs. 1 and 2, these graduations extend from 0 to 250. A second dial or disc **220** is mounted on shaft **200** in front of the front surface of dial **204** and is so mounted on the shaft that it may rotate with respect to the shaft and the dial **204**. An annular series of graduations **221** is marked on dial **220** adjacent the periphery thereof and extends in reverse order to the series of graduations **210** and, in the disclosed embodiment, this series extends from 0 to 250. Dial **220** has a cylindrical knob **222** concentrically attached to its front surface in surrounding relation to the knob **206** on shaft **200** and a series of graduations **224** may be marked on the outer cylindrical surface of this knob and will correspond in number and position to the peripheral series on the front surface of dial **220**. A felt disc **230** surrounds shaft **200** and it is positioned between dials **204** and **220** and is in face to face engagement with both of them. A pressure plate **232** surrounds the shaft **200** within the knob **222** in front of dial **220** and is separated from the dial by a felt disc **233**. The pressure plate is constantly

urged into engagement with the front surface of the felt disc **233** by a spring **234** which surrounds shaft **200** and bears at its one end on plate **232** and at its other end on the inner surface of knob **206**, thus holding dials **204** and **220**, pressure plate **232** and the intermediate felt discs in frictional engagement. A pointer **240** is connected at its lower end to the upper frame part **23** and extends upwardly therefrom behind dial **204** and at its upper end is turned outwardly and downwardly across the outer peripheral parts of dials **204, 220**, to provide an indicating edge **242** which is positioned adjacent the series of graduations on the two dials.

In the use and operation of the embodiment of the invention disclosed in Figs. 4 and 5, the operating device is mounted on the carriage **8** by assembling the fitting **22** to the carriage shaft **10** and by connecting the adapter **58** to the knob **14** of the operating shaft **12**. The two parts **20, 23** of the frame are now separated by moving the part **23** about its pivotal connection to part **20**, thus moving gear **74** out of mesh with gear **54**. Both dials **204** and **220** are now separately rotated by their respective knobs until the zero indication on both dials is opposite the indicator edge **242**. If it is assumed that parallel lines .160 inch apart are to be drawn on the sheet on work surface **4** the smaller or front dial **220** is turned in a counterclockwise direction by its knob **222** until the 160 mark on its scale registers with the indicator edge **242**. It will be seen that this rotation of dial **220** will not turn shaft **200** or the gears **74, 54** or the operating shaft **12** of the carriage **8**, as dial **220** is not connected to shaft **200**. When the described rotation of dial **220** has been made the knob **206** is rotated in a clockwise direction until the zero graduation on dial **220** registers with the indicator edge **242**. This rotation of knob **206** will cause the same rotation of dial **204**, shaft **200**, gear **74**, gear **54** and carriage operating shaft **12**, thus producing a carriage and straightedge movement of .160 inch in the manner and for the reason described hereinbefore in connection with the embodiment of Figs. 1 and 2. The carriage movement may be repeated any number of times by rotating the dial **220** in a counterclockwise direction to the position in which its 160 mark registers with the indicator edge **242**, without rotating the dial **204** at all, and then rotating both dials in the opposite direction until the zero graduation on dial **220** registers with the indicator edge **242**.

The dial **204** indicates in thousandths of an inch any movement of the carriage or straightedge. Thus, if it should be desired or necessary to draw two lines .010 inch apart and then another pair of such spaced lines after an interval of .160 inch, the dial **204** would be used to produce the .010 inch spacing of the lines of each pair and the dial **220** would be used to produce the spacing between pairs of lines.

While we have described and illustrated two embodiments of our invention, it will be apparent to those skilled in the arts to which the invention relates that other embodiments, as well as modifications of those disclosed, may be made and practised without departing in any way from the spirit or scope of the invention, for the limits of which reference must be made to the appended claims.

What is claimed is:

1. A device for turning the operating shaft of a line-up table to impart movement to a movable straightedge forming part of such table and which is adapted and intended to be moved upon rotation of the shaft to permit the drawing of parallel lines, comprising a relatively large rotatable gear, means for attaching said gear to the operating shaft of the table, a relatively small rotatable gear meshed with the first gear, a circular dial connected to said relatively small gear for rotation therewith and having graduations marked about its periphery, ratchet teeth on the periphery of said dial, a pawl operatively associated with said ratchet teeth to prevent rota-

tion of said dial in one direction and permit rotation in the other direction, an arm mounted for rotation with respect to the dial, a pawl on said arm operatively related to said ratchet teeth in a direction opposite to the first pawl, whereby the pawl on the arm rides over the teeth in one direction of movement of the arm, in which direction of movement the dial is held from rotation by the first pawl, and whereby the pawl on the arm causes rotation of the dial when moved in the other direction, in which direction of movement of the dial the first pawl rides over the ratchet teeth.

2. A device for turning the operating shaft of a line-up table to impart movement to a movable straightedge forming part of such table and which is adapted and intended to be moved upon rotation of the shaft to permit the drawing of parallel lines, comprising a relatively large rotatable gear, means for attaching said gear to the operating shaft of the table, a relatively small rotatable gear meshed with the first gear, a circular dial connected to said relatively small gear for rotation therewith and having graduations marked about its periphery, adjustable stop means movable about the periphery of the dial, means for fixing said stop means in any predetermined position with respect to the graduations on the dial, ratchet teeth on the periphery of said dial, a pawl operatively associated with said ratchet teeth to prevent rotation of said dial in one direction and permit rotation in the other direction, an arm mounted concentrically with said dial for rotary movement with respect thereto and having a part positioned to be engaged by said stop means to stop rotation of the arm upon such engagement, a pawl on said arm operatively related to said ratchet teeth in a direction opposite to the first pawl, whereby the pawl on the arm rides over the teeth in one direction of movement of the arm until engaged and stopped by said stop means, in which direction of movement the dial is held from rotation by the first pawl, and whereby the pawl on the arm causes rotation of the dial when moved in the other direction from the stop means, in which direction of movement of the dial the first pawl rides over the ratchet teeth.

3. A device for turning the operating shaft of a line-up table to impart movement to a movable straightedge forming part of such table and which is adapted and intended to be moved upon rotation of the shaft to permit the drawing of parallel lines, comprising a relatively large rotatable gear, means for attaching said gear to the operating shaft of the table, a relatively small rotatable gear meshed with the first gear, an annular member which is fixed with respect to said gears and which has an arcuate opening therein, a stop device having parts extending through said opening and being movable along the opening from end to end thereof, means for fixing said stop device at any predetermined position along the opening, a dial connected to said relatively small gear for rotation therewith and having graduations marked about its periphery, ratchet teeth on the periphery of said dial corresponding in number and positions to the graduations thereon, a pawl mounted on said annular member and operatively associated with said ratchet teeth to prevent rotation of said dial in one direction and permit rotation in the other direction, an arm mounted concentrically with said dial for rotary movement with respect thereto and having a part positioned to be engaged by said stop means to stop rotation of the arm upon such engagement, a pawl on said arm operatively related to said ratchet teeth in a direction opposite to the first pawl, whereby the pawl on the arm rides over the teeth in one direction of movement of the arm until engaged and stopped by said stop means, in which direction of movement the dial is held from rotation by the first pawl, and whereby the pawl on the arm causes rotation of the dial when moved in the other direction from the stop means, in which direction of movement of the dial the first pawl rides over the ratchet teeth.

4. In combination with a line-up table having a work surface, a carriage movable along said work surface and including a transverse shaft and a straightedge which extend in parallelism across the work surface to permit parallel lines to be drawn as the carriage is moved, and means including a rotatable shaft for causing movement of the carriage upon rotation of the shaft, a device for causing rotation of said shaft comprising a frame mounted on the transverse shaft of said table, a relatively large gear rotatably mounted in said frame, means connecting said gear to the rotatable shaft of said table, a relatively small gear mounted in said frame and meshed with said relatively large gear, a bracket mounted on said frame and having an arcuate opening therein extending through the greater part of 360°, a stop device movable along said arcuate opening and having means for fixing the stop device in any predetermined position along its length, a dial rotatably mounted in said frame and having graduations marked about its periphery, means connecting said dial to said relatively small gear, ratchet teeth on the periphery of said dial, a pawl mounted on said bracket for engagement with the ratchet teeth on said dial to prevent rotation of said dial in one direction and permit rotation in the other direction, means constantly urging said pawl into engagement with said ratchet teeth, an arm rotatably mounted on said frame concentrically with said dial for rotation with respect thereto, a second pawl mounted on said arm for engagement with the ratchet teeth on said dial to permit rotation of the dial in the direction opposite to that permitted by the first pawl, whereby the pawl on the arm rides over the ratchet teeth in one direction of movement of the arm and rotates the dial in the other direction of movement of the arm, and means on said arm positioned to be engaged by said stop device whereby the arm or the arm and the dial may be rotated through any desired arc.

5. A device for turning the operating shaft of a line-up table to impart movement to a movable straightedge forming part of such table and which is adapted to be moved upon rotation of the shaft to permit the drawing of parallel lines, comprising a frame having two parts which are pivotally connected together, a relatively large rotatable gear journaled in one part of the frame and a relatively small rotatable gear journaled in the second part of the frame and positioned to be meshed with the large gear whereby the two gears may be meshed by bringing the two parts of the frame together and may be unmeshed by separation of the two parts of the frame, means operatively connecting the large gear to the operating shaft of the table, a rotatably mounted circular dial having graduations marked about its periphery, and means operatively connecting said dial to the small gear to cause rotation of the large gear and the operating shaft of the table and movement of the straightedge upon rotation of the dial.

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