Aug. 30, 1966 F. I. GASE 3,269,014

DRAFTING METHOD AND MACHINE

Original Filed April 16, 1958 4 Sheets-Sheet 1

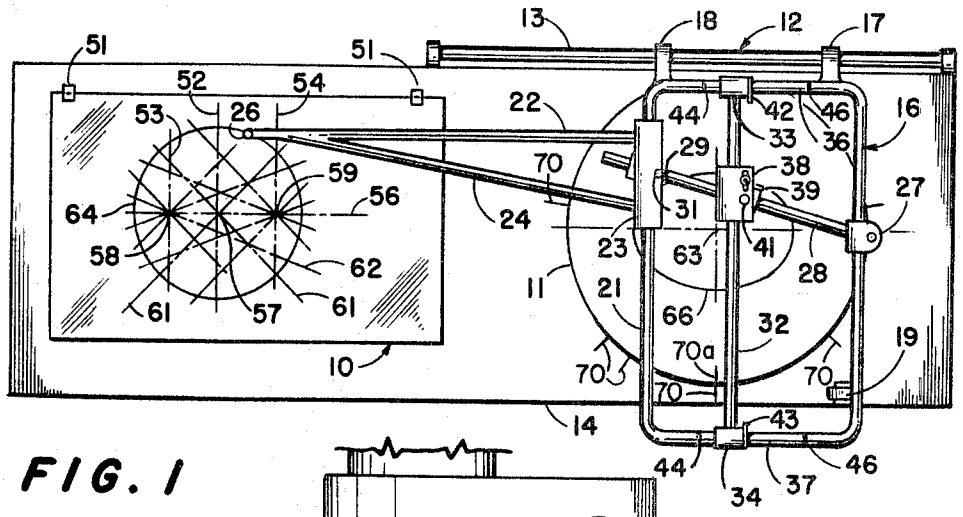


FIG. 1

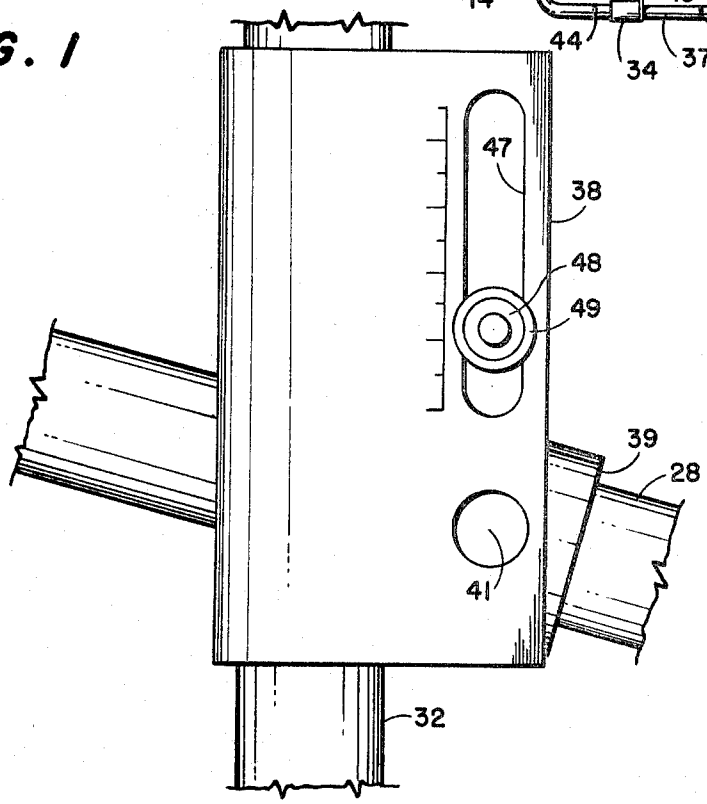


FIG. 2

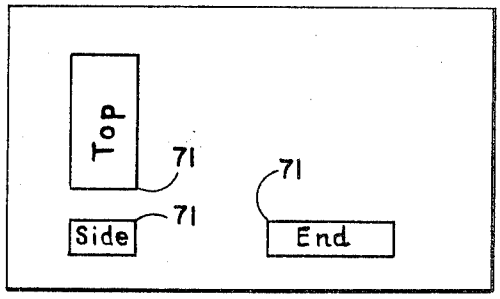
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FIG. 3



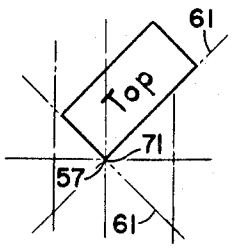


FIG. 4a

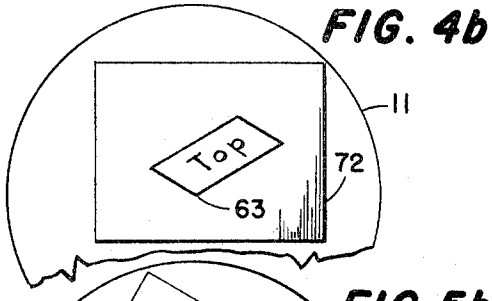


FIG. 4b

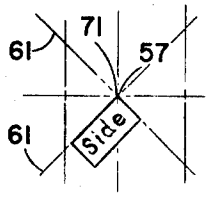


FIG. 5a

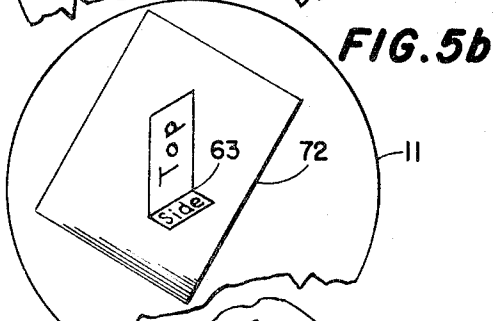


FIG. 5b

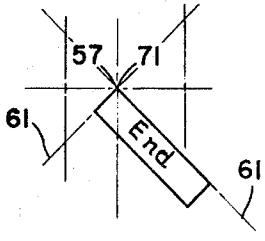


FIG. 6a

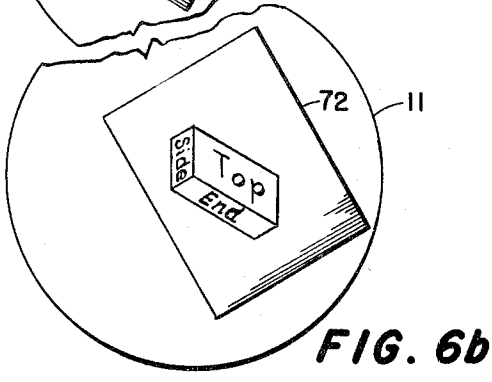


FIG. 6b

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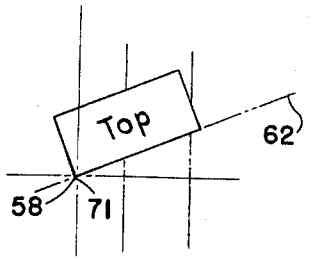


FIG. 7a

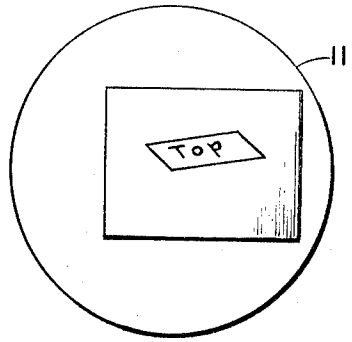


FIG. 7b

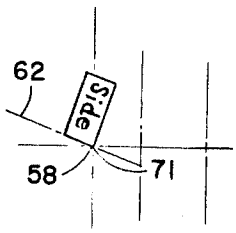


FIG. 8a

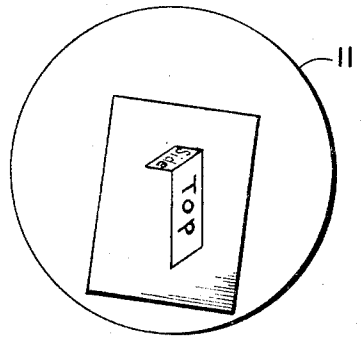


FIG. 8b

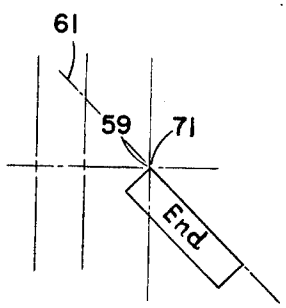


FIG. 9a

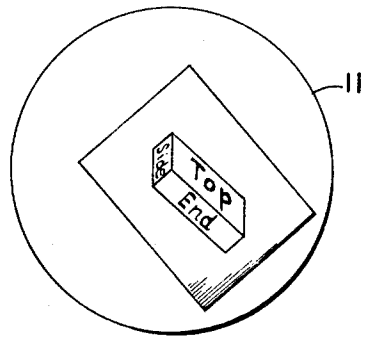


FIG. 9b

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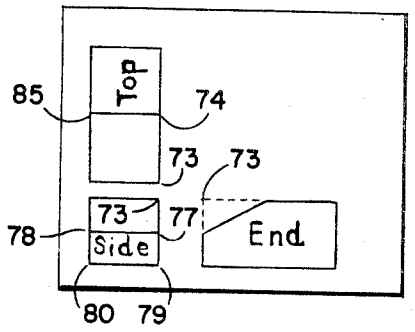


FIG. 10

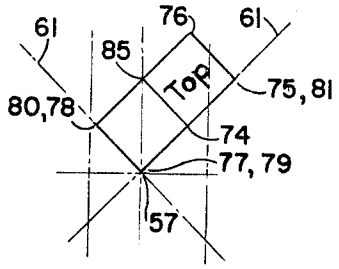


FIG. 11a

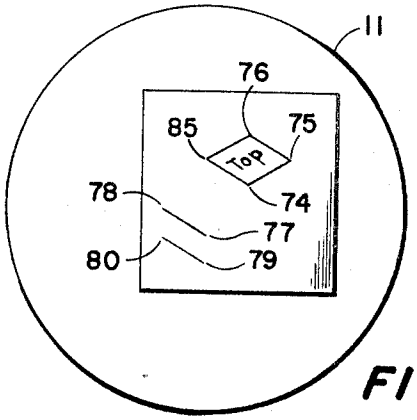


FIG. 11b

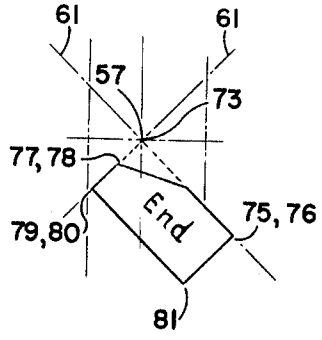


FIG. 12a

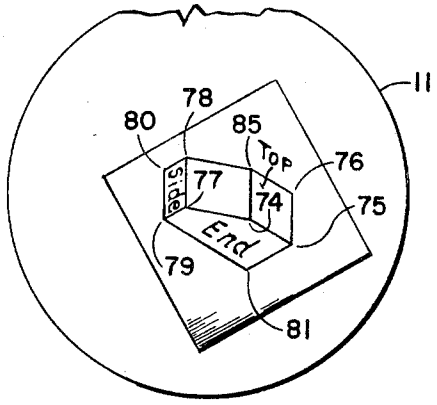


FIG. 12b

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United States Patent Office 3,269,014 Patented August 30, 1966

3,269,014

DRAFTING METHOD AND MACHINE

Franklin I. Gase, Starke, Fla.; Bertha M. Pieffer, executrix, of said Franklin I. Gase, deceased

Continuation of application Ser. No. 728,883, Apr. 16, 1958. This application Dec. 19, 1963, Ser. No. 331,897
6 Claims. (Cl. 33—23)

This application is a continuation of my application S.N. 728,883, filed April 16, 1958, entitled Drafting Method and Machine, now abandoned.

This invention relates generally to drafting mechanisms and more particularly to a method and machine for making pictorial drawings.

It is an important object of this invention to provide a drafting method and machine which permits an operator to trace normal views and automatically produce pictorial drawings of any desired type.

It is another important object of this invention to provide a drafting method and machine which automatically produces isometric or dimetric drawings.

Further objects and advantages will become apparent from the following description and drawings, wherein:

FIGURE 1 is a plane view of a drafting machine according to this invention;

FIGURE 2 is an enlarged fragmentary view of the mechanism utilized to change the plane of tracing by adjusting the position of the drawing point;

FIGURE 3 is a reproduction of a drawing of a rectangular object shown in normal orthographic views;

FIGURES 4*a* and 4*b* illustrate the first operation in drawing an isometric view of the object shown in FIGURE 3 wherein the top view is put into pictorial illustration;

FIGURES 5*a* and 5*b* are similar to FIGURES 4*a* and 4*b* showing the second step in making the pictorial view wherein the side is added;

FIGURES 6*a* and 6*b* show the final step of the isometric drawings wherein the end is added;

FIGURES 7*a* and 7*b* illustrate the first step in drawing a dimetric view of the object shown in FIGURE 3 wherein the top view is traced;

FIGURES 8*a* and 8*b* show the second step wherein the side is added;

FIGURES 9*a* and 9*b* illustrate the third step wherein the end view is added;

FIGURE 10 is a reproduction of a normal drawing of a second object showing the end, top and side views;

FIGURES 11*a* and 11*b* illustrate the first step in making a pictorial view of the object shown in FIGURE 10; and,

FIGURES 12*a* and 12*b* illustrate the final step of making the isometric drawing of the object shown in FIGURE 10.

The use of a machine according to this invention permits unskilled draftsmen to trace the normal views of an object and produce substantially any desired pictorial view. The mechanism includes the combination of a tracing board, a drawing board pivoted for rotation about an axis for combining of the view, a linkage for reproducing objects traced wherein movement in at least one direction is proportionally changed, and means for changing the relative position of the tracing in the one direction. The linkage is in effect a mechanism for generating an ellipse when the tracing point is moved in a circular path. Those skilled in the art will recognize that pictorial views are produced by foreshortening an object in one or more planes and that an ellipse generating machine produces this foreshortening action. The different types of pictorial drawings are made with different degrees of foreshortening so the ellipse generating machine must provide means for adjusting the degree of proportional change of movement in the one direction to change the degree of foreshortening.

Referring to the drawings the preferred combination includes a tracing board **10** which the drawing to be reproduced is placed on, a rotatable drawing board **11** on which the pictorial drawing is made, and an ellipsograph linkage **12**. For purposes of description the term "horizontal" will refer to the horizontal direction in the drawings when they are held upright and the term "vertical" will refer to the vertical direction on the drawings when viewed in this manner. It should be understood that these terms are only used as a convenient designation and that the drawing machine may be placed in any position relative to the true horizontal and vertical. The ellipsograph **12** reproduces the tracing movement in a horizontal direction while proportionally changing the magnitude of movement in the vertical direction. The amount of the proportional change of magnitude determine the degree of foreshortening and in turn determines the degree of the plane of viewing in the pictorial drawing reproduced. By adjusting the degree of the proportional change, it is possible to adjust the degree of foreshortening and therefore adjust the angle of the plane of viewing.

The ellipsograph **12** includes a stationary horizontally extending bar or guide **13** which is mounted on a drafting table **14**. A frame **16** is positioned over the drawing board **11** and provided with two spaced bearings **17** and **18** which are axially movable along the guide **13**. To support the lower end of the frame **16**, I provide the roller **19** which moves along the lower edge of the drafting table **14**. The frame **16** is therefore constrained to move in a plane above the drafting table **14** in a manner wherein the movement of any point on the frame is parallel to the axis of the guide **13**. The frame is provided with a guide bar **21** which extends vertically normal to the axis of the guide **13** on which is mounted a tracing arm **22** which is movable along the axis of the guide bar **21**. To provide stability of the tracing arm **22**, I utilize a relatively long bearing **23** and a stiffening bar **24**. Supported on the outer end of the tracing arm **22** is a tracing point **26** which can be moved along any desired path over the tracing board **10**. To those skilled in the art will recognize that any vertical movement of the tracing point **26** will produce vertical movement of the tracing arm **22** and the bearing **23** along the guide bar **21** and any horizontal movement of the tracing point **26** will cause the frame **16** to move horizontally along the guide **13**. Therefore, the two directions of the movement, horizontal and vertical, are separated so that the horizontal component is transmitted as horizontal movement of the frame **16** and vertical movement appears only between the bearing **23** and the frame **16**.

Pivotally mounted at a fixed point **27** on the frame **16** is a rod **28** which extends through and is journaled in a bearing **29** which is in turn pivotally mounted in the bearing **23** for rotation relative thereto around a pivot axis **31**. Vertical movement of the bearing **23** is therefore translated into pivotal movement of the rod **28** around the fixed point **27**. An adjustable guide **32** is supported by bearings **33** and **34** on guide portions **36** and **37** of the frame **16** so that it is always parallel to the guide bar **21**. The guide portions **36** and **37** are parallel to the guide **13** and the various elements are arranged so that adjustable guide **32** can be moved horizontally relative to the frame **16**. Mounted on the adjustable guide **32** is a slide bearing **38** which is axially movable therealong and pivotally mounted in the slide bearing **38** is a second slide bearing **39** which is axially movable along the rod **28** and movable relative to the bearing **38** around a pivot axis **41**. This mechanism is a

double scotch yoke wherein vertical movement of the bearing **23** produces vertical movement of the slide bearing **38** wherein movement of the slide bearing **38** is equal to the movement of the bearing **23** times a constant. This constant can be changed by moving the adjustable guide **32** along the guide portions **36** and **37** to change the distance of the axis **41** from the points **27** and **31**. If the adjustable guide **32** could be moved to a position wherein the axis **41** is coaxial with the axis **31**, both the slide bearing **38** and the bearing **23** would have the same magnitude movement. Conversely, if the axis **41** could be moved to be coaxial with the point **27**, there would be no movement of the slide bearing **38** in response to movement of the bearing **23**. But in any given position between these two extremes the slide bearing **38** moves through a distance having a constant ratio relative to the movement of the bearing **23** in a vertical direction which constant is changed by adjustment of the guide **32**.

The adjustable guide **32** is illustrated in FIGURE 1 in a position wherein a point on the slide bearing **38** will move in a 35° ellipse when the tracing point **26** is moved in a circle which is the degree of viewing the planes used for isometric drawings. To secure the adjustable guide **32** in this position, I form the guide portions **36** and **37** with calibrated notches into which lock pieces **42** and **43** carried by the bearings **33** and **34** respectively, fit. Additional notches **46** are provided on the guide portions **36** and **37** to receive the lock pieces **42** and **43** when a 19½° ellipse is to be generated and another set of notches **44** are provided to receive the lock pieces when a 62° ellipse is to be generated which are the settings used for dimetric drawings. Those skilled in the art will recognize that the frame **16** and adjustable guide **32** cooperate to form a first linkage which transmits full movement between the tracing point **26** and the drawing point in the horizontal direction and that the rod **28** and its bearings cooperate to form a second linkage which transmits vertical movement between the tracing point **26** and drawing point **28**. The second linkage, however, operates to proportionally change the magnitude of vertical movement transmitted to give the foreshortening necessary in pictorial drawings.

Referring to FIGURE 2, the slide bearing **38** is provided with a vertical slot **47** along which a drawing point **48** can be adjusted. Any suitable drawing point can be used, such as a pen or pencil of the normal or ball point type, depending upon the type of finished drawing desired. Threaded onto the case of the drawing point is a lock nut **49** which is tightened to secure a drawing point in any desired position along the slot **47**. Once the adjustable guide **32** is locked in a given position, it moves horizontally with the frame **16** carrying with it the slide bearing **38**. Therefore, the drawing point **48** moves horizontally the same distance as a tracing point **26**. However, due to the double scotch yoke mechanism, vertical movement of the tracing point **26** is reduced so that the drawing point **48** moves vertically through a distance which is a constant function of the vertical movement of the tracing point.

The tracing board **10** is preferably formed of a two sheet envelope of transparent plastic which contains the drawing being traced and is hinged to the drafting table **14** by hinges **51** so that a drawing may be positioned under the plastic. Scribed on the tracing board **10** are three vertical guide lines **52**, **53** and **54** and a single horizontal line **56** which represents the viewing plane for the pictorial drawings and which intersects the lines **52** through **54** at the designated points **57**, **58** and **59** respectively. In addition the plastic is scribed with diagonal lines **61** at a 45° angle relative to the horizontal line **56** and guide lines **62** at 21° relative to the horizontal line **56**.

The drawing board **11** is pivoted on the drafting table **14** for rotation around on axis **63** and the paper on which the pictorial view is to be made is mounted on top of the drawing board **11** with drafting tape. Assuming that the adjustable guide **32** is at the 35° setting, if the tracing point **26** is moved along a circle **64** having its center at the point **57**, the drawing point **48** will draw a 35° ellipse **66** on a piece of paper positioned on the drawing board **11**. If the tracing point **26** were moved around a square or rectangle positioned 45° on the tracing board **10** with its edges along the 45° lines **61**, the drawing point **48** would produce a parallelogram which would be the pictorial view of the rectangle in a 35° plane.

Reference should now be made to FIGURES 3 to 6*b* for an understanding of one method of producing an isometric drawing of a rectangular object definable by mutually perpendicular end, side and top planes. It is understood that the object need not be rectangular to be so definable. As is commonly known, an isometric drawing is one form of pictorial drawing, a pictorial drawing being a projection from the object to a viewing plane. The viewing plane makes certain angles with the end, side and top planes defining the object. In the case of the isometric drawing equal 45° angles are made with all three planes of the object. In FIGURE 3, the normal top, end and side views of a rectangular object are shown. To produce an isometric view of the objects shown in FIGURE 3, it is merely necessary to follow the three steps shown in FIGURES 4*a* and 4*b* through 6*a* and 6*b*. First, a point of viewing **71**, common to and shown in all three views, is chosen and the top view is positioned under the tracing board with the viewing point **71** at the designated point **57** on the tracing board. The top view should also be oriented so that the sides extend at 45° relative to the horizontal viewing plane line. The adjustable guide **32** is then positioned to produce 35° ellipses which is the degree of projection used in an isometric drawing and the drawing point **48** is adjusted along the slot **47** until it is over the axis **63** when the tracing point **26** is over the designated point **57**. The tracing point **26** is then moved completely around the top view. This will reproduce the figure shown in FIGURE 4*b* on a piece of paper **72** on the drawing board **11** wherein the top of the object is shown as it would appear in the isometric with the viewing point **71** located at the center **63** of the drawing board **11**. After this operation is completed the side view is positioned under the designated point **57** with the viewing point **71** coincident therewith and rotated so that the sides extend at 45° relative to the horizontal along the guide lines **61** as shown in FIGURE 5*a*. Before the side view is traced the drawing board **11** should be rotated around the point **63** in a counterclockwise direction through 60° so that the top view already traced extends vertically from the point **63** with the junction of the top and the end planes vertical as shown. It is desirable to provide calibration lines **70**, shown in FIGURE 1, on the table **14** with which reference mark **70***a* on the drawing board **11** can be aligned to indicate the proper amount of rotation of the drawing board. The side view is then traced and it appears in the isometric form in proper position joined to the previously drawn top view as shown in FIGURE 5*b*. To complete the isometric drawing, the viewing point **71** of the end view is positioned under the designated point **57** on the tracing board and is oriented at 45° relative to the horizontal as shown in FIGURE 6*a*. The drawing board **11** is also rotated in a clockwise direction through 120° to a reference line so that it is 60° of clockwise rotation from the initial position placing the junction of the top and the side planes vertical. The end view is then traced by the tracing point **26** and appears in isometric view connected to the previous drawn top and end views on the paper **72**. To assist in tracing the various views it is desirable to use normal drawing instruments such as T-squares and triangles or templates or a typical drafting machine to guide the tracing point **26** over the various views.

To make a dimetric drawing wherein the object is foreshortened to half scale in one direction, the steps

shown in 7*a* through 9*b* are followed. Here again the rectangular object shown in FIGURE 3 will be traced to form a pictorial view. In this case, however, the viewing plane makes equal angles of 21° with the side and end planes of the object, and an angle of 45° with the top plane. This is only one of the numerous forms of dimetric drawings, my invention being capable of making all of them. In this case the top view is positioned as shown in FIGURE 7*a* with the viewing point **71** under the point **58** on the tracing board and oriented so that one of its sides, defining the end plane, extends along the guide line **62**, 21° from the horizontal. In this case the adjustable guide **32** is positioned so that the lock pieces **42** and **43** are in the notches **46** and the 19½° viewing plane is used. Because the adjustable guide **32** is moved to the right in this adjustment and it carries with it the drawing point **48**, it is necessary to use the designated point **58** on the tracing board so that the drawing point **48** will be over the point **63** when the drawing point is over the designated point **58** on the tracing board **10**. When the top view is traced, the drawing point **48** produces the top view as it would appear in a 19½° plane as shown in FIGURE 7*b*. The side view is then added by positioning the side view so that the point **71** is over the designated point **58** on the tracing board and is positioned so that one of its sides, defining the end plane, extends along the guide lines **62** as shown in FIGURE 8*a*. Before the side view is traced the drawing board **11** must be rotated in a clockwise direction through 97° 11′ so that the previous drawn top view is in a vertical position with the junction of the top and the end planes is vertical as shown or until the reference lines of the drawing board and table coincide. Upon tracing of the side view, it appears as it would in a 19½° plane connected to the previously drawn top view as shown in FIGURE 8*b*. To complete the dimetric drawing the end view is positioned with the viewing point **71** under the designated point **59** on the tracing board with the sides positioned at 45° relative to the horizontal. The end view is drawn in a 62° plane so the guide bar **32** must be adjusted so that the lock pieces **42** and **43** are positioned in the notches **44**. Because the adjustable guide **32** is moved to the left relative to the frame, it is necessary to use the designated point **59** on the tracing board so that the views will properly coincide. Before the end view is traced the drawing board **11** is rotated in a counterclockwise through 46° 36′ so that the board is displaced from its original position in a clockwise direction 48° 35′ with the junction of the top and side planes vertical as shown. When the end view is traced it appears as shown in FIGURE 9*b* completing the dimetric drawing.

In some cases it is possible to produce isometric or dimetric views with only one or two steps as shown in FIGURES 10 through 12*b*. In FIGURE 10 an object to be drawn is shown in its normal top and side and end views. Here again a viewing point **73** appearing in all three views is chosen as a reference point. For purposes of illustration, I have shown an imaginary viewing point **73** which is the projection of the corner which would be present if a full rectangular object were present. This is normally only done when actual points which appear in all three views are not conveniently available. The top view is positioned on the tracing board with the viewing point **73** under the designated point **57** on the board and the sides positioned under or parallel to the guide lines **61**. Because only the area within the rectangle connecting the corners **74**, **75**, **76** and **85** are in top plane of the object, this portion of the top view is traced and appears as shown in FIGURE 11*b*. Because this is an isometric drawing the adjustable guide **32** is in the mid-position so that the object will appear in 35° planes. To draw the face and edges connecting the points **77** and **78** and the edge connecting the points **79** and **80**, it is necessary to move the drawing point **48** along the slot **47** to move to the horizontal planes containing these edges. When making an isometric view, vertical displacement is reduced by .81 of the vertical displacement between the point **73** and the point **77** so the drawing point **48** is moved down the slot a distance equal to .81 of the distance between the points **73** and **77**. The line between **77** and **78** of the top view is then traced and appears as shown in FIGURE 11*b*. Because the edge connecting **79** and **80** is vertically below the edge **77** and **78**, the drawing device **48** is again moved down along the slot a distance equal to .81 of the vertical displacement between these two edges and the line **79** and **80** is traced and appears as shown in FIGURE 11*b*.

The side view is next drawn by the steps shown in FIGURES 12*a* and 12*b*. In this case the end view is positioned with the viewing point **73** positioned under the designated point **57** on the tracing board oriented at 45° relative to the horizontal. The drawing board **11** is then rotated in a clockwise direction through 60° and the drawing device **48** is adjusted along the slot **47** until it is directly over the point **75** of the side view when the tracing point **26** is placed on the point **75** of the side view of the orthographic drawing. The side view is then traced to add the lines connecting the points **75**, **74**, **77**, **79**, **81** and back to the point **75**. To fill in the upper part of the figure, it is then necessary to adjust the drawing device **48** upward along the slot **47** until it is on the point **76** of the isometric drawing when the tracing point **26** is on the point **76** of the side view. The side view is then traced to connect the points **85**, **78** and **80**. Because the other edges of the side view would be hidden they are not traced. By following this procedure, a pictorial view can be made in two steps.

The necessary elements of the drafting machine according to this invention include an ellipsograph which is capable of proportionately reducing movement in at least one direction, a tracing board on which the views to be traced can be positioned, a drawing board which can be rotated around a center and means for moving from one plane to another within the figure drawn and also a means for moving the tracing drawing for spacing of planes. In the device shown, vertical movement from one plane to another is achieved by moving the drawing point **48** along the slot **47**. However, the same effect can be achieved by moving either the tracing board **10** or the drawing board **11** vertically relative to each other.

Although I have described the operation of drawing only isometric and dimetric drawings, it should be understood that the machine can be used to make other types of pictorial drawings including trimetric drawings. For such drawings, it would be necessary to use different degrees of projection and different guide lines on the drawing table. I have, however, only shown the two most commonly used pictorial types of drawings because they clearly demonstrate the operation of the device.

Although the preferred embodiment of this invention is illustrated, it will be realized that various modifications of the structural details may be made without departing from the mode of operation and the essence of the invention. Therefore, except insofar as they are claimed in the appended claims, structural details may be varied widely without modifying the mode of operation. For instance, an ellipsograph may be used which is capable of adjustment in the degree of vertical foreshortening without changing the horizontal distance between the tracing point and the drawing point, in which case only one instead of three designated points is needed on the tracing board for location of the viewing point on the views to be traced. Accordingly, the appended claims and not the aforesaid detailed description are determinative of the scope of the invention.

What is claimed as new and what it is desired to secure by Letters Patent of the United States is:

1. The method of making a pictorial drawing from a mutli-view projection of an object definable by mutually

perpendicular end, side and top planes, the pictorial drawing being a projection from the object to a viewing plane, said viewing plane making first, second and third angles with the end, side and top planes respectively, comprising the steps of:

orienting the top view on a tracing board so that the end and side planes make the first and second angles respectively with a horizontal line representing the viewing plane on the tracing board, and with a viewing point common to all views located at a designated point;

tracing the top view with the tracing point of an ellipsograph which reproduces the top view with vertical dimensions reduced compared with horizontal dimensions on a drawing board by means of a drawing point;

orienting the side view on the tracing board so that the top and end planes make the third and first angles respectively with the viewing plane, and with the viewing point located at the designated point;

rotating the reproduced top view about the viewing point to a new position so the junction of the top and end planes is vertical for proper joinder of a side view;

tracing the side view with the tracing point so that the view is reproduced on the drawing board properly joined to the reproduced top view;

orienting the end view on the tracing board so that the top and side planes make the third and second angles respectively with the viewing plane, and with the viewing point located at the designated point;

rotating the joined reproduced top and side views about the viewing point to a new position so the junction of the top and side planes is vertical for proper joinder of an end view;

tracing the end view with the tracing point so that the view is reproduced on the drawing board properly joined to the reproduced top and side views, completing the pictorial drawing.

2. The method of making an isometric drawing from a multi-view projection of an object definable by three mutually perpendicular planes, the isometric drawing being a projection from the object to a viewing plane, said viewing plane making equal angles of 45° with the three planes of the object, comprising the steps of:

orienting the top view on a tracing board with the end and side planes at 45° angles with a horizontal line representing the viewing plane on the tracing board, and with a viewing point common to all views located at a designated point;

tracing the top view with the tracing point of an ellipsograph which reproduces the top view with vertical dimensions reduced compared with the horizontal dimensions on a drawing board by means of a drawing point;

orienting the side view on the tracing board with the top and end planes at 45° angles with the viewing plane and with the viewing point located at the designated point;

rotating the reproduced top view about the viewing point to a new position so the junction of the top and end planes is vertical for proper joinder of a side view;

tracing the side view with the tracing point so that the view is reproduced on the drawing board properly joined to the reproduced top view;

orienting the end view on the tracing board with the top and side planes at 45° angles with the viewing plane and with the viewing point located at the designated point;

rotating the reproduced top and side views of the isometric drawing about the viewing point to a new position so the junction of the top and side planes is vertical for proper joinder of an end view; and

tracing the end view with the tracing point so that the view is reproduced on the drawing board properly joined to the reproduced top and side views, completing the isometric drawing.

3. The method of making an isometric drawing from a multi-view projection of an object definable by three mutually perpendicular planes, the isometric drawing being a projection from the object to a viewing plane, said viewing plane making equal angles of 45° with the three planes of the object, comprising the steps of:

orienting the top view on a tracing board with the end and side planes at 45° angles with a horizontal line representing the viewing plane on the tracing board, and with a viewing point common to all views located at a designated point, the view extending above the designated point;

tracing the top view with the tracing point of an ellipsograph which reproduces the top view with vertical dimensions reduced compared with horizontal dimensions on a drawing board by means of a drawing point;

orienting the side view on the tracing board with the top and end planes at 45° angles with the viewing plane and with the viewing point located at the designated point, the view extending below the designated point;

rotating the reproduced top view of the isometric drawing about the viewing point to a new position 60° counterclockwise removed from the position in the second step above so the junction of the top and end planes is vertical for proper joinder of a side portion;

tracing the side view with the tracing point so that the view is reproduced on the drawing board properly joined to the reproduced top view;

orienting the end view on the tracing board with the top and side planes at 45° angles with the viewing plane and with the viewing point located at the designated point, the view extending below the designated point;

rotating the reproduced top and side views of the isometric drawing about the viewing point to a new position 60° clockwise removed from the position in the second step above so the junction of the top and side planes is vertical for proper joinder of an end view; and

tracing the end view with the tracing point so that the view is reproduced on the drawing board properly joined to the reproduced top and side views, completing the isometric drawing.

4. The method of making a dimetric drawing from a multi-view projection of an object definable by three mutually perpendicular planes, the dimetric drawing being a projection from the object to a viewing plane, said viewing plane making equal angles of 21° with the side and end planes of the object, and an angle of 45° with the top plane of the object, comprising the steps of:

orienting the top view on a tracing board so that the end plane makes a 21° angle with a horizontal line representing the viewing plane on the tracing board, and so that a viewing point common to all views is located at a designated point;

tracing the top view with the tracing point of an ellipsograph which reproduces the top view with vertical dimensions reduced compared with horizontal dimensions on a drawing board by means of a drawing point;

orienting the side view on the tracing board so that the end plane makes a 21° angle with the viewing plane and so that the viewing point is located at the designated point;

rotating the reproduced top view of the dimetric drawing about the viewing point to a new position so the junction of the top and end planes is vertical for proper joinder of a side view;

tracing the side view with the tracing point so that

the view is reproduced on the drawing board properly joined to the reproduced top view;

orienting the end view on the tracing board so that the top plane makes a 45° angle with the viewing plane and so that the viewing point is located at the designated point;

rotating the reproduced top and side view of the dimetric drawing about the viewing point to a new position so the junction of the top and side planes is vertical for proper joinder of an end view; and

tracing the end view with the tracing point so that the view is reproduced on the drawing board properly joined to the reproduced top and side views, completing the dimetric drawing.

5. The method of making a dimetric drawing from a multi-view projection of an object definable by three mutually perpendicular planes, the dimetric drawing being a projection from the object to a viewing plane, said viewing plane making equal angles of 21° with the side and end planes of the object, and an angle of 45° with the top plane of the object, comprising the steps of:

orienting the top view on a tracing board so that the end plane makes a 21° angle with a horizontal line representing the viewing plane on the tracing board, and so that a viewing point common to all views is located at a designated point, the view extending above the designated point;

tracing the top view with the tracing point of an ellipsograph which reproduces the top view with vertical dimensions reduced compared with horizontal dimensions on a drawing board by means of a drawing point;

orienting the side view on the tracing board so that the end plane makes a 21° angle with the viewing plane and so that the viewing point is located at the designated point, the view extending above the designated point;

rotating the reproduced top view of the dimetric drawing about the viewing point to a new position 97° 11′ clockwise removed from the position in the second step above so the junction of the top and end planes is vertical for proper joinder of a side view;

tracing the side view with the tracing point so that the view is reproduced on the drawing board properly joined to the reproduced top view;

orienting the end view on the tracing board so that the top plane makes a 45° angle with the viewing plane and so that the viewing point is located at the designated point, the view extending below the designated point;

rotating the reproduced top and side views of the dimetric drawing about the viewing point to a new position 48° 35′ clockwise removed from the position in the second step above so the junction of the top and side planes is vertical for proper joinder of an end view; and

tracing the end view with the tracing point so that the view is reproduced on the drawing board properly joined to the reproduced top and side views, completing the dimetric drawing.

6. A drawing machine for producing a pictorial drawing of an object comprising a tracing board, a drawing board, and an ellipsograph including a tracing point, a drawing point and means linking said points operative to transmit full movement therebetween, said tracing board holding a multi-view projection having a designated viewing point common to all views of the object, said ellipsograph reproducing a traced view of said object with reduced vertical dimensions compared with the horizontal dimensions thereof on said drawing board, mounting means for rotatably positioning said drawing board beneath said drawing point, said drawing point coinciding with the rotational axis of said drawing board when said tracing point is at said designated viewing point on said tracing board, said ellipsograph reproducing various views of said object on said drawing board from said multi-view projection on said tracing board properly and automatically joined together thereby producing the pictorial drawing of the object on said drawing board.

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