April 28, 1953 L. VALOIS 2,636,271

PROJECT-O-GRAPH

Filed May 5, 1951 4 Sheets-Sheet 1

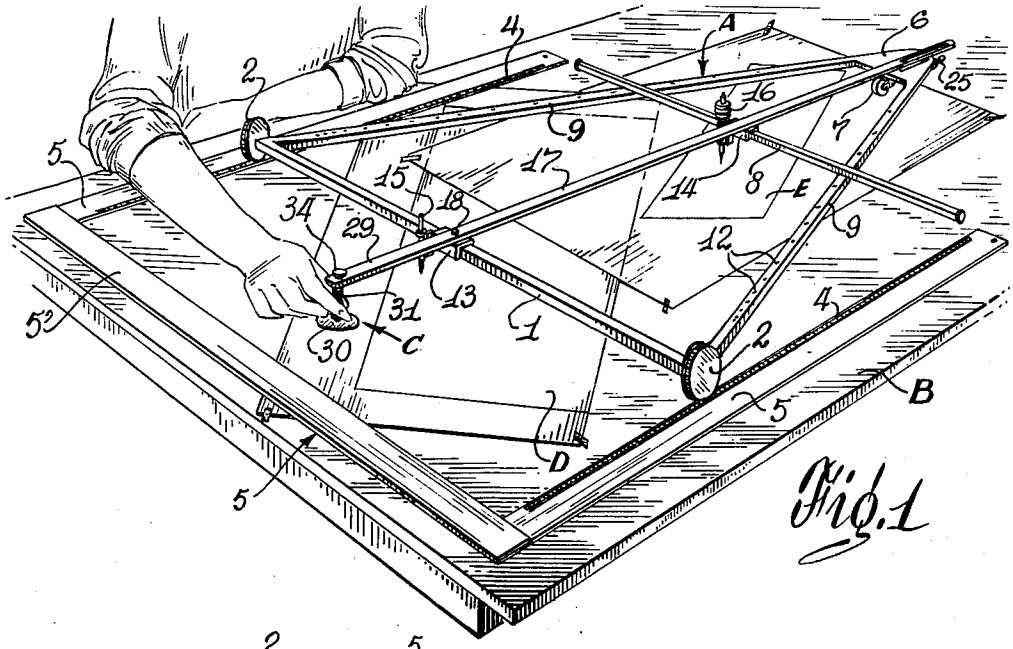


Fig. 1

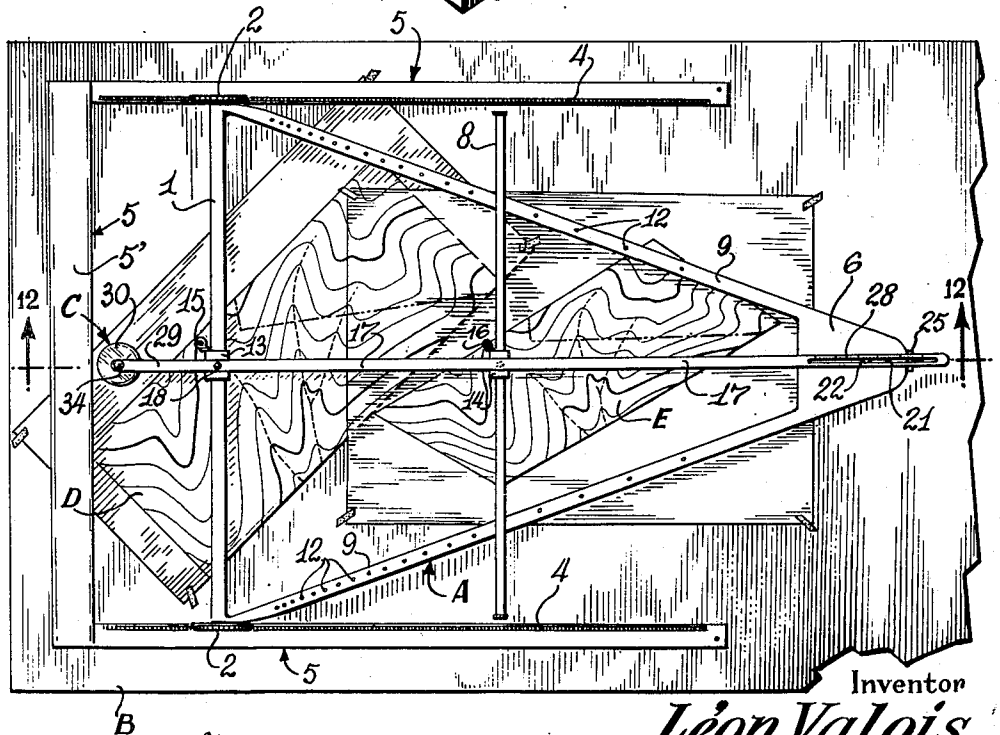


Fig. 2

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Fig. 3

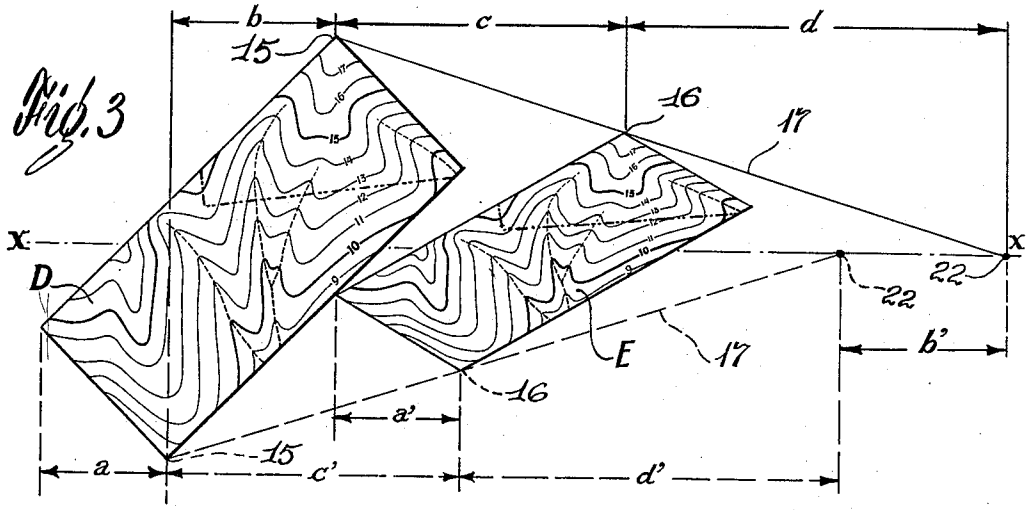


Fig. 4

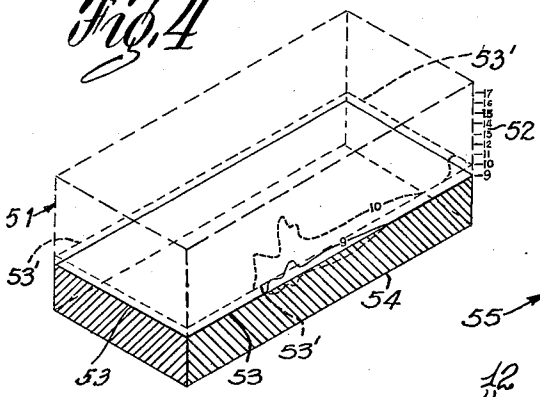
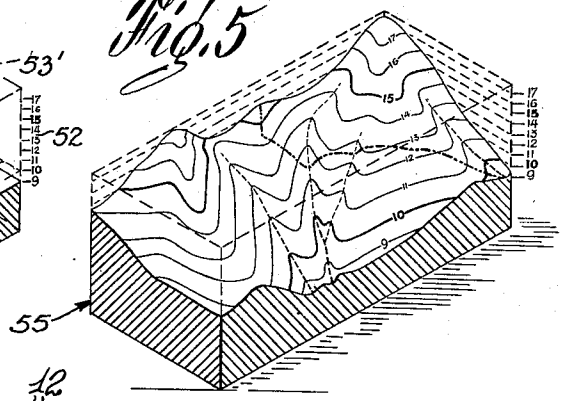


Fig. 5



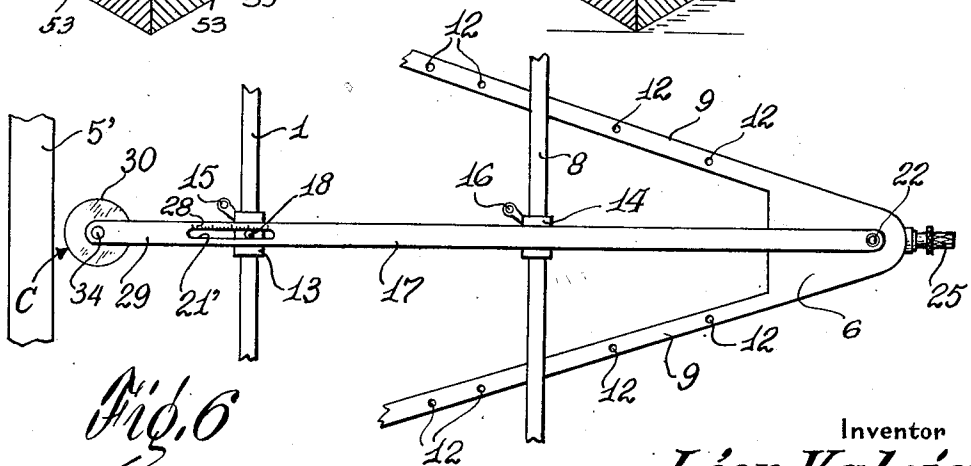


Fig. 6

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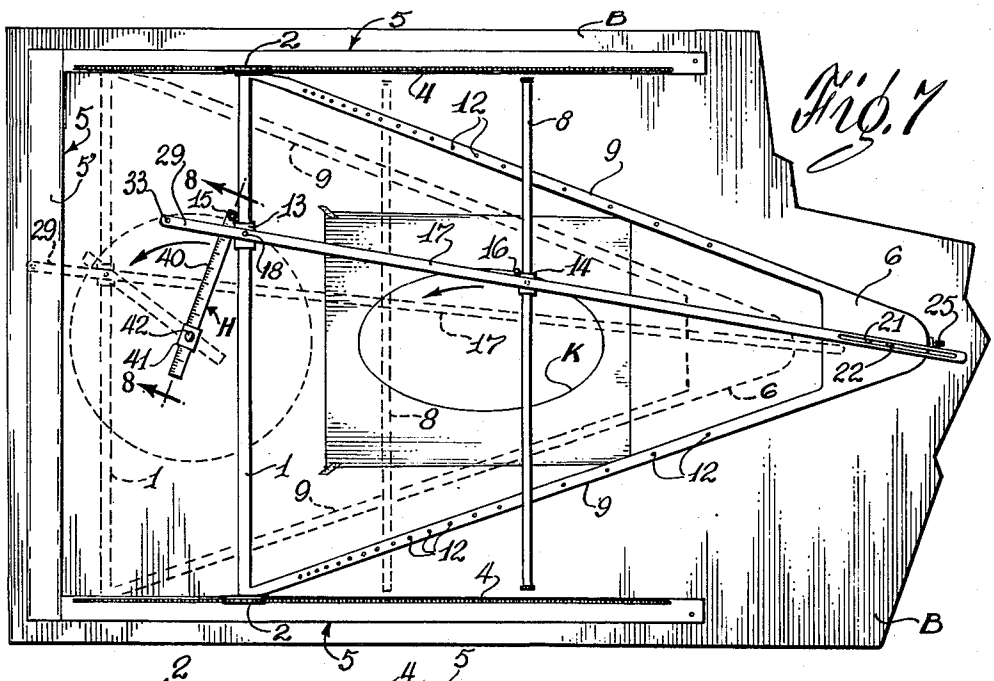


Fig. 7

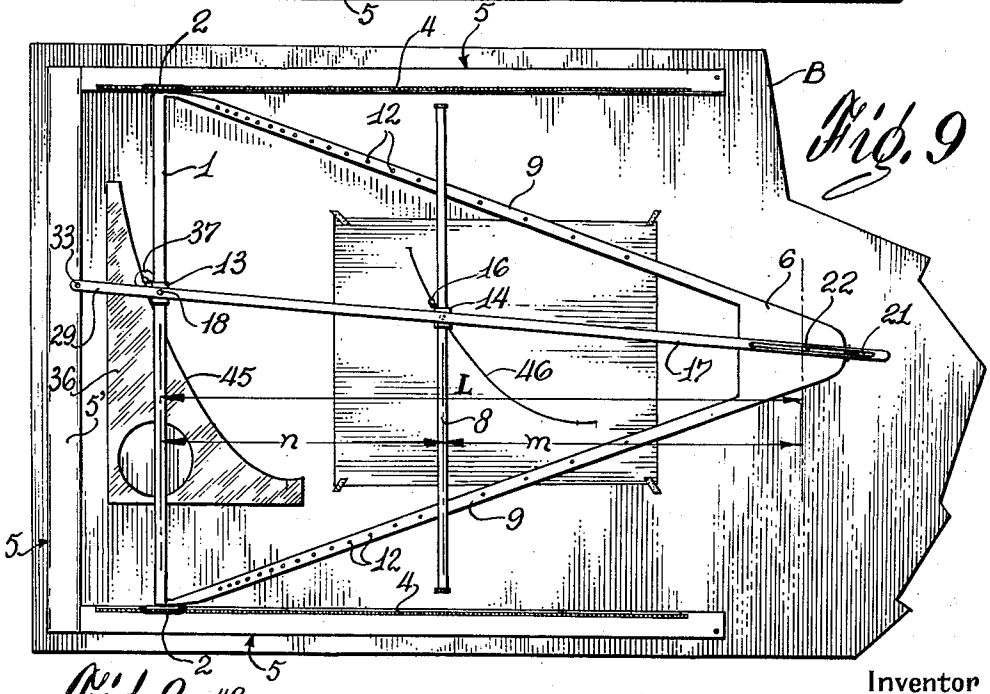


Fig. 9

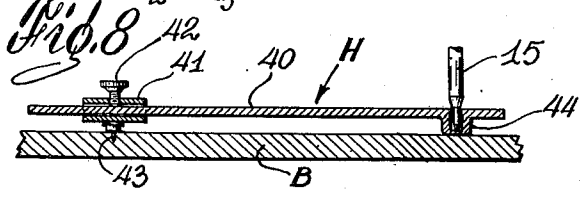


Fig. 8

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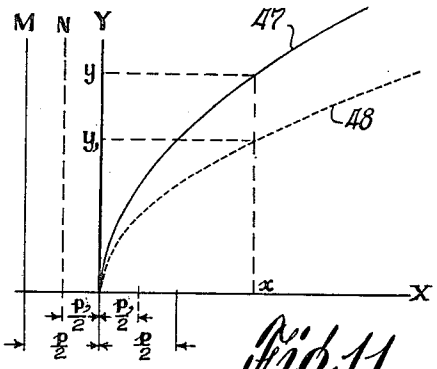


Fig. 11

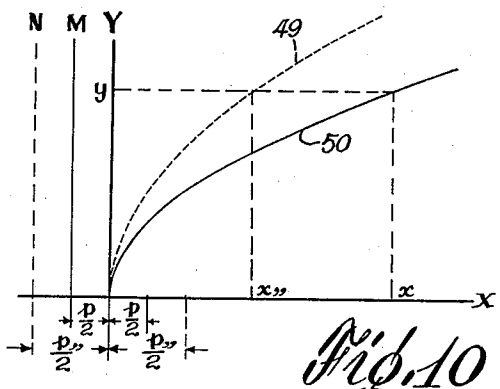


Fig. 10

Fig. 12

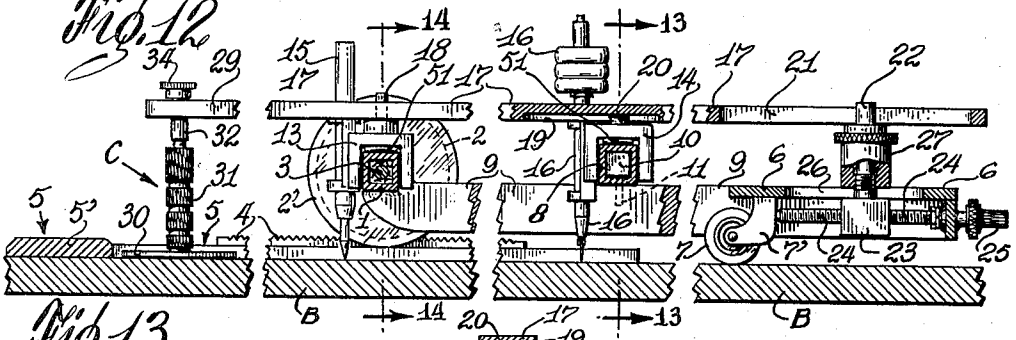
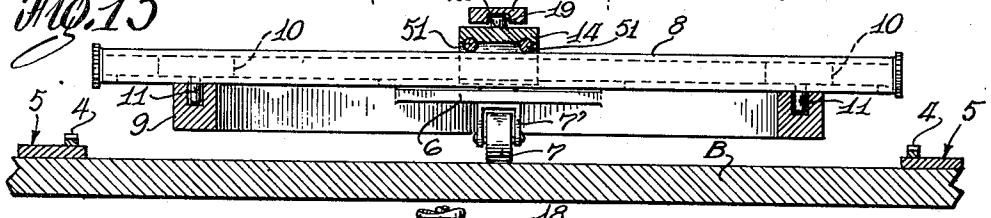


Fig. 13



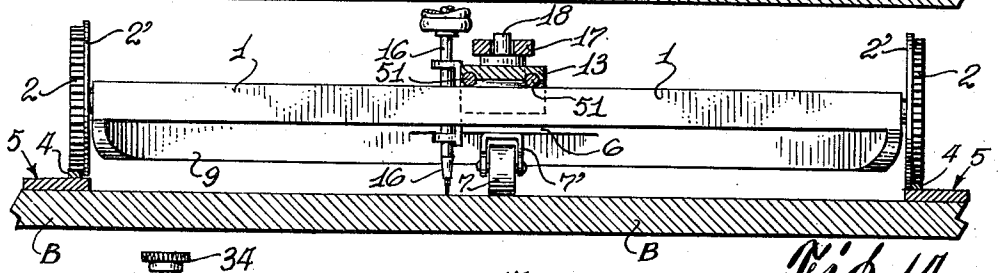


Fig. 14

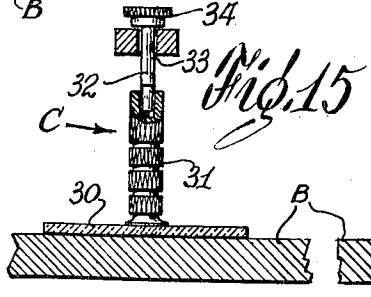


Fig. 15

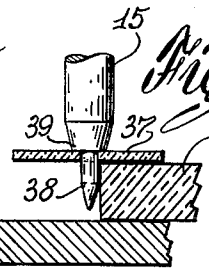


Fig. 16

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UNITED STATES PATENT OFFICE

2,636,271

PROJECT-O-GRAPH

Léon Valois, Sillery, Quebec, Canada

Application May 5, 1951, Serial No. 224,773

13 Claims. (Cl. 33—23)

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The present invention relates to a drafting instrument and more particularly to a drafting instrument of the planograph class which provides means to retrace a drawing in such a manner that its dimensions will be changed in one direction only.

The drafting instrument according to the invention may be properly called a projectograph because the drawing obtained thereby constitutes a projection of the original drawing.

The instrument according to the present invention is different from a pantograph in that with the latter instrument a drawing may be reduced or increased in size equally in all directions whereas with the projectograph according to the invention the drawing is reduced or increased in size in only one direction while it is reproduced to its true dimensions in the direction at right angles to the first one.

Drafting instruments of the character described have already been constructed in which an arm is slidably pivoted at one end and carries a tracing and a marking stylus whereby a drawing may be recopied or retraced and at the same time have their dimensions varied to present a picture with an elongated or deformed appearance and design. But in these instruments, the styli move over a more or less circular or arcuate path, therefore they cannot be considered as varying the dimensions of the drawings in one direction only as is the case for the present instrument.

Accordingly the main object of the present invention is the provision of a drafting instrument which is capable in a highly accurate manner to retrace a drawing with variations of its dimensions in one direction only while the dimensions in the direction at right angles to the first will be retraced to their true length.

Still another important object of the present invention is a drafting instrument of the character described in which the ratio of reduction or increase may be continuously varied from a minimum to a maximum limit.

Still another important object of the present invention is the provision of a drafting instrument of the character described in which the retracing may be effected with high accuracy because the inherent unequal frictional resistances in various directions of movement of the styli are made ineffective by the addition of a substantially uniform frictional resistance of a much higher order: this is done by providing the instrument with a so-called friction drowner in the form of a plate adapted to come into frictional contact with the drafting table.

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Still another important object of the present invention is the provision of an instrument of the character described which is capable of drawing ellipses of different shapes and dimensions from a circle and also parabolae of various shapes from a given parabola.

Yet another important object of the present invention is the provision of an instrument of the character described which will be found very convenient in the drawing of isometric and like pictorial views from plan, elevational and/or sectional views of an object.

Yet another important object of the present invention is the provision of a drafting instrument of the character described which may be used in an unorthodox manner to do fancy lettering.

The foregoing and other important objects of the present invention will become more apparent during the following disclosure and by referring to the drawings in which:

Figure 1 is a perspective view of the drafting instrument according to the invention in use on a drafting table;

Figure 2 is a plan of the same showing one application of the instrument;

Figure 3 is a schematic view showing the principles of functioning of the instrument according to the invention; Figures 4 and 5 show the successive steps for drawing a block diagram from the tracing effected by the instrument according to the invention;

Figure 6 shows in plan a modification of the instrument according to the invention;

Figure 7 shows another application of the instrument according to the invention for drawing ellipses from a circle;

Figure 8 is a section along line 8—8 of Figure 7;

Figure 9 shows still another application of the invention in which parabolae of different shapes may be drawn from a given parabola;

Figures 10 and 11 are schematic views of parabolae retraced with their dimensions reduced respectively along the X and Y axes;

Figure 12 is a broken sectional elevation of the instrument according to the invention;

Figure 13 is a cross-sectional elevation along line 13—13 of Figure 12;

Figure 14 is a cross-sectional elevation along line 14—14 of Figure 12;

Figure 15 is an enlarged sectional elevation of the so-called friction drowner according to the invention; and

Figure 16 is an elevation of the tracing stylus used with a guiding disc shown in section for the application illustrated in Figure 9.

Referring now more particularly to the drawings in which like reference characters indicate like elements throughout, the instrument according to the present invention comprises a rigid triangular frame generally indicated by the letter A movable over the flat surface of the drafting table B. The triangular frame A is adapted to move along a straight line without rotation over the table B.

In order to obtain this displacement, at the ends of the straight hollow base member 1 of the triangular frame A are mounted a pair of gear wheels 2 of equal diameter keyed to a common shaft 3 shown in Figure 12 which shaft extends through the entire length of the base member 1. The gear wheels 2 are adapted to come in meshing engagement with the straight parallel racks 4 rigidly mounted on the parallel legs of a rigid U-shaped frame 5 laid on the table B. Because the gear wheels 2 revolve exactly in unison, the triangular frame A will always move along a line perpendicular to the cross-member 5' of the frame 5.

The gear wheels 2 have a flange 2' projecting from their inner peripheral edge to prevent sideways disengagement from the racks 4.

The triangular frame A is supported at its apex by means of an idle wheel 7 freely rotatable over the table B in a plane parallel to the planes of rotation of the gear wheels 2. The wheel 7 is journalled in a bracket 7' secured underneath the plate 6 secured to the apex of the frame A.

A straight bar 8 is removably supported on the triangular frame A and more particularly on the straight side members 9 of said triangular frame. This bar 8 has preferably a square cross-section and is hollow to slidably receive a pair of blocks 10 shown in Figure 12 provided with a downwardly extending pin 11 for removably engaging any one of a plurality of spaced holes 12 made on both side members 9.

The holes 12 are opposed in pairs on each side member 9 such that the distance of the holes in each pair from the base member 1 is always equal. Thus when the pins 11 of the bar 8 are inserted into the holes 12 of any one of these pairs, the bar 8 will be parallel to the base member 1

The distance from the base member 1 of the successive holes 12 on any one of the side members 9 is conveniently chosen to obtain successive steps in the variation of reduction or increase ratios of the drawing instrument according to the invention.

Stylus carrying members 13 and 14 having an inverted U-shaped cross-section are slidably mounted on the base member 1 and the bar 8 respectively. As shown in Figures 13 and 14 the members 13 and 14 are preferably mounted on roller bearings 51 partially imbedded in the top portion of said members.

The stylus carrying members 13 and 14 may mount alternatively a marking or a tracing stylus. In the figures, the tracing stylus 15 is shown secured to the carrying member 13 for displacement along the base member 1 of the triangular frame A while the marking stylus 16 is secured to the carrying member 14 and is displaceable along the bar 8.

A straight elongated arm 17 is pivoted at the apex portion of the triangular frame A and is pivotally connected to the carrying member 13 by receiving a pin 18 projecting upwardly from said carrying member 13. The straight arm 17 is also provided with a longitudinal groove 19 shown in Figure 12 extending a substantial distance underneath said arm 17 to slidably receive an upwardly projecting pin 20 upstanding from the stylus carrying member 14.

The pivoted end of the arm 17 is provided with a longitudinal slot 21, as shown in Figure 12, for receiving an upwardly projecting pivot pin 22 which is adjustably displaceable longitudinally of the triangular frame A preferably but not necessarily in a direction parallel to the direction of displacement of said frame. More particularly the pivot pin 22 is rigidly secured to a bored block 23 threadedly receiving a horizontally extending bolt 24 which is rotatably journalled underneath the apex plate 6 of the frame A. A knurled knob 25 is secured to the projecting end of the bolt 24 for rotation of the same and displacement of the block 23 and pivot pin 22. The latter projects through a longitudinal slot 26 made in the apex plate 6. To lock the pivot pin 22 in a given adjusted position the latter is threaded to receive a locking collar 27 the rotation of which will grip the plate 6 between itself and the block 23.

The length of displacement of the pivot pin 22 relatively to the triangular frame A, will be such as to ensure a continuous variation in the increase or reduction ratio of the projectograph from a maximum to a minimum limit when adjusted in cooperation with the setting of the movable bar 8 in holes 12.

Therefore for obtaining a given ratio of increase or reduction, the movable bar 8 will be first set in the pair of holes 12 which will give a value nearest to said desired ratio and a final adjustment will be effected through knob 25 by adjusting the position of the pivot pin 22 opposite the desired graduation of the scale 28 marked along an edge of the slot 21 of the arm 17. The scale 28 will give the distance from the pivot pin 22 to the base member 1.

With this arrangement a continuous increase or decrease in the ratio of reduction or increase of the instrument is obtained with a very high accuracy.

The length of the longitudinal slot 21 of the arm 17 will be such as to take care of the longitudinal displacement of the pivot pin 22 and also the displacement of the arm 17 when the latter is pivoted on said pivot pin 22 from side to side of the triangular frame A.

The arm 17 preferably extends outwardly from the base member 1 of the triangular frame at its end opposite the slot 21 to form a manipulating projection 29 at the free end of which is removably secured the manipulating device generally indicated by the letter C.

Said manipulating device comprises a disc 30 of relatively substantial diameter horizontally disposed and adapted to frictionally contact the surface of the drafting table B, said disc 30 being rigidly secured to the upright shank 31 the upper end of which is bored to receive the tapered end of a rod 32 freely engaging a hole 33 made at the free end of the arm projection 29 said rod 32 being terminated at its upper end by a stop flange 34. To remove the manipulating device C from the arm 17 it is only necessary to disengage the tapered end of the rod 32 from the bored end of the shank 31.

The drafting instrument according to the invention is normally operated as shown in Figure 1 by holding the manipulating device C. Because such a drafting instrument cannot have an equal resistance to motion in all directions of displacement, although the frictional resistances

of said instrument have been reduced to a minimum, it is necessary to add a frictional resistance of much greater value than said inherent frictional resistances of the instrument which additional resistance will be equal in all directions of movement. Such an additional resistance is provided by the friction disc 30 of the manipulating device C and the latter is properly called a "friction drowner."

When the instrument is used with a template such as the template 36 shown in Figure 9 the tracing stylus 15 is preferably provided with a perforated guiding disc 37 shown in Figure 16 made of transparent material and engaging the free point 38 of said stylus 15 to abut the shoulder 39 of the same and rest on the edge of the template 36 in such a manner to prevent contact of the free point 38 with the surface of the drafting table.

Figure 6 shows a modification of the straight arm 17 which is pivoted on but is not slidable relatively to the pivot pin 22, and is pivotally and slidably connected to the stylus carrying member 13 at the base member 1, the pin 18 of said carrying member engaging the corresponding slot 21' of the arm 17.

With this modification, the strains caused by the displacement of the projectograph will be carried by the pivot pin 22 and not by the base member 1.

The drafting instrument according to the invention is used to advantage in the preparation of isometric drawings, pictorial perspectives and block diagrams, an example of the latter being shown in Figures 2 to 5. In this example, a contour map D is laid on the drawing table B at an angle relatively to the direction of displacement of the projectograph preferably at 45° angle and said contour map is retraced at E with a reduction of all the dimensions lying at right angles to the line of displacement of the triangular frame A. There is obtained a parallelogram with all the contour lines deformed accordingly. As shown in Figures 4 and 5 a block diagram may be prepared directly from said resulting parallelogram. For example the block 51 shown in Figure 4 is drawn on tracing paper with contour line levels 52 marked along one or more corners of the block 51. Lines 53, 53' are then drawn parallel to the base 54 of the block 51, at each level 52. The parallelogram E is then placed under the tracing paper so that its edges will register with the lines 53 at level marker 9 and then the contour line 9 of the parallelogram E is retraced on the block 51 as shown in Figure 4. The parallelogram E is next displaced so that its edges register with the line 53' at level marked 10 and the contour line 10 of the parallelogram E is retraced on the block 51. This procedure is continued for all the contour lines until the final block diagram 55, shown in Figure 5, is obtained.

Referring to Figure 3, it will be noted that all the dimensions of the original map D and retraced map E, parallel to the longitudinal axis XX of the projectograph are respectively equal, for instance the distance a is equal to a', only the dimensions lying at right angles to said axis XX are reduced in the retraced map E.

Also it should be noted that the displacement b of the stylus measured along a line parallel to the axis XX will be equal to the displacement b' of the pivot of the arm 17 along the axis. Similarly c is equal to c' and d is equal to d'.

The instrument according to the invention may also be used for retracing true ellipses of any desired contour from a circle.

As shown in Figure 7 a circular movement of the desired diameter may be imparted to the tracing stylus 15 of the instrument by means of an auxiliary device or circle tracer generally indicated by the letter H. This device comprises a straight scale member 40 on which is slidable as shown in Figure 8 a sleeve 41 which may be clamped in any desired position along said scale member 40 by a set screw 42. The sleeve 41 carries a table engaging pin 43 rigidly secured to the underface thereof. At the outer end of the scale member 40 is provided a cup shaped recess or hole 44 for receiving the point of the tracing stylus 15, the pin 43 constitutes the center of the circle and the scale member 40 the radius of the same. It will be obvious that the tracing stylus engaging the cup shaped recess or hole 44 will trace a circle the radius of which will depend on the position of the sleeve member 41 on the scale member 40.

The ellipse K retraced by using the circle tracer H will have its long axis equal to the diameter of the circle from which it is retraced and the length of its short axis will depend on the reduction factor at which the projectograph is set. Obviously if the marking stylus 16 is placed at the outer end of the arm 17 and the device H together with the tracing stylus 15 placed at the intermediate portion of said arm 17 it will result that the short axis of the retraced ellipse H will be equal to the diameter of the circle from which it is retraced and the long axis of said ellipse will be proportional to the amount of increase ratio to which the instrument is set.

As shown in Figures 9, 10 and 11, with the projectograph according to the invention one can trace any parabola from a first parabola of which the parameter p is known. The first parabola will be provided by the template 36 one edge 45 of which has a parabolic contour, and the tracing stylus 15 will be provided with the transparent guiding disc 37 to follow said parabolic edge 45 and thereby the second parabolic curve 46 will be retraced by the marking stylus 16.

The equation of the parabola 47 shown in Figure 11 and having a directrix M is

$$y^2=2px$$

The new parabola 48 obtained by modification of the scale in a direction parallel to the Y axis has a directrix N and the equation

$$y'^2=2p'x$$

in which $y'=ry$ and p' is the new parameter, r being the factor of modification given by the adjustment of the projectograph.

The value of the new parameter in relation to the value of the parameter of the initial parabola 47 may be calculated as follows:

$$p'=\frac{y'^2}{2x}=\frac{r^2y^2}{2x}=r^2p$$

Therefore, to obtain a parabola of parameter p' from an original parabola of parameter p, the adjustment of the apparatus is calculated as follows:

$$r=\sqrt{\frac{p'}{p}}$$

if the variation of the scale is parallel to the directrix of the parabola.

Similarly if the new parabola is obtained by modification of the scale in a direction parallel

to the X axis as shown in Figure 10, one can obtain a new curve 49 the equation of which is:

$$y^2=2p''x''$$

in which $x''=rx$ and p''=new parameter, r being the factor of modification given by the adjustment of the projectograph.

The value of the new parameter in relation to the value of the parameter of the initial parabola 50 may be calculated as follows:

$$p''=\frac{y^2}{2x''}=\frac{y^2}{2rx}=\frac{p}{r}$$

Therefore, to obtain a parabola of parameter p'' from an original parabola of parameter p the adjustment of the apparatus is calculated as follows:

$$r=\frac{p}{p''}$$

if the variation of the scale is parallel to the axis of the parabola.

When the instrument is used for reducing, the factor r becomes a reduction factor and is given by the formula

$$r=\frac{m}{L}=\frac{L-n}{L}$$

wherein L is the distance from the base member 1 to the pivot pin 22; m is the distance from the movable bar 8 to the pivot pin 22, and n is the distance between the movable bar 8 and the base member 1 (see Figure 9).

L may vary about 4 inches due to the longitudinal adjustment of the pivot pin 22 on the triangular frame A. To obtain a desired reduction, the movable bar 8 is first set into the desired pair of holes 12 and the final adjustment is made by setting the pivot pin 22, said setting being given by the formula:

$$L=\frac{n}{1-r}$$

Varying the height of the triangle with the adjustable pivot pin 22 assures a greater accuracy of the reduction factor because any displacement of the movable bar corresponds to a greater displacement of said pivot pin. Also the parallelism of the base member 1 and the movable bar 8 is not dependent on the operator.

While preferred embodiments according to the present invention have been illustrated and described, it is understood that various modifications may be resorted to without departing from the spirit and scope of the appended claims.

What I claim is:

1. An instrument of the character described comprising a frame displaceable along a straight line and without rotation, two straight spaced members mounted on said frame and extending transversely to the direction of displacement of the same, a pivot mounted on said frame at a predetermined distance from said members, a stylus carrying member slidably mounted on each of said members, a pivot mounted on each of said stylus carrying members, and an arm pivoted on one of said three pivots and slidably and pivotally mounted on the other two pivots whereby arcuate movements of said arm about said first mentioned pivot will cause the displacement of said stylus carrying members along said transverse members.

2. An instrument of the character described comprising a movable frame, means for guiding the displacement of said frame along a straight line and without rotation, two straight spaced members mounted on said frame and extending transversely to the direction of displacement of said frame, a pivot fixedly mounted on said frame at a predetermined distance from said straight members, a straight arm pivoted on said pivot, a stylus carrying member slidably mounted on each one of said straight members and each having a pivot engaging said arm along a straight line passing through said first mentioned pivot, said arm being longitudinally slidable relatively to two of said pivots, whereby the arcuate movement of said arm will displace said stylus carrying members along their respective straight members.

3. An instrument of the character described comprising a movable frame, means for guiding the displacement of said frame along a straight line and without rotation, two straight spaced members mounted on said frame and extending transversely to the direction of displacement of said frame, a pivot fixedly mounted on said frame at a predetermined distance from said straight members, a straight arm slidably and pivotally mounted on said pivot, a stylus carrying member slidably mounted on one of said straight members and slidably and pivotally connected to said arm, another stylus carrying member slidably mounted on the other of said straight members and pivotally connected to said arm along a straight line passing through the pivot connection of said arm to said frame whereby the arcuate movement of said arm will displace said stylus carrying members along their respective straight members.

4. An instrument of the character described comprising a movable frame, means for guiding the displacement of said frame along a straight line and without rotation, two straight spaced members mounted on said frame and extending transversely to the direction of displacement of said frame, a straight arm pivotally mounted on said frame on a fixed pivot spaced from said straight members, a stylus carrying member slidably mounted on each one of said straight members and slidably and pivotally connected to said arm along a straight line passing through the pivot connection of said arm to said frame whereby the arcuate movement of said arm will displace said stylus carrying members along their respective straight members.

5. An instrument of the character described comprising a movable frame, means for guiding the displacement of said frame along a straight line without rotation, two straight spaced members mounted on said frame and extending transversely to the direction of displacement of said frame, a pivot mounted on said frame at a point spaced from said straight members, a straight arm pivoted on said pivot, a stylus carrying member slidably mounted on each of said straight members and connected to said arm at the intersection of the latter with said straight members, at least one of said stylus carrying members being slidable relatively to said arm, a marking stylus and a tracing stylus carried by said stylus carrying members.

6. A drafting instrument of the character described comprising a frame movable over a flat surface, means for guiding the displacement of said frame along a straight line and without rotation over said flat surface, two spaced straight members mounted on said frame and extending transversely to the direction of displacement of said frame, means to adjustably

vary the distance separating said straight members, a pivot mounted on said frame at a point spaced from said straight members, an arm pivoted on said pivot, a stylus carrying member slidably mounted on each of said straight members and connected to said arm to be displaced thereby along said members.

7. A drafting instrument of the character described comprising a frame movable over a flat surface, means for guiding the displacement of said frame along a straight line and without rotation, two straight spaced members mounted on said frame and extending transversely to the direction of displacement of said frame, an arm pivoted on said frame at a point spaced from said straight members, a stylus carrying member slidably mounted on each of said members, one of said straight members rigidly fixed relatively to said frame and extending at right angles relatively to the direction of displacement of said frame, the stylus carrying member slidably mounted on said fixed member being pivotally connected to said arm, the other of said straight members being removably mounted on said frame and securable at predetermined varying distances from said fixed member, the stylus carrying member mounted on said removable member being pivotally connected to said arm, whereby the arcuate movement of said arm will displace said stylus carrying members along said straight members.

8. A drafting instrument of the character described, comprising a frame movable over a flat surface, means for guiding the displacement of said frame along a straight line and without rotation over said flat surface, said frame including an integral member extending transversely to the direction of displacement of said frame; a second member removably affixable to said frame, means to secure said second member to said frame at various pre-determined distances from said first member, a pivot pin mounted on said frame at a point spaced from said two members, an arm engaging said pivot pin, a stylus carrying member slidably mounted on each of said members and connected to said arm to be displaced thereby along said members.

9. A drafting instrument of the character described, comprising a frame movable over a flat surface, means for guiding the displacement of said frame along a straight line and without rotation, an integral straight member of said frame lying transversely of the direction of displacement of said frame, a second straight member removably affixable to said frame at predetermined varying distances from said first integral member, a pivot pin mounted on said frame at a point spaced from said two members, an arm pivotally engaging said pivot pin, a stylus carrying member slidably mounted on each of said straight members and connected to said arm at the inter-sections of the latter with said straight members whereby the arcuate movement of said arm displaces said stylus carrying members on said straight members, a tracing stylus and a marking stylus mounted on said stylus carrying members, the position of said styli being interchangeable.

10. A drafting instrument of the character described, comprising a frame movable over a flat surface, means for guiding the displacement of said frame along a straight line and without rotation over said flat surface, said frame including a first integral straight member extending transversely to the direction of displacement of said frame, a second straight member removably affixable to said frame at pre-determined varying distances from said first straight member, a pivot pin mounted on said frame at a point spaced from said two straight members, said pivot pin adjustably displaceable on said frame for varying its distance from said first straight member, an arm having one end engaging said pivot pin to pivot on said frame, said arm projecting at its other end from said first member, a plate depending from said projecting end of said arm adapted to come into frictional contact with said flat surface, a stylus carrying member slidably mounted on each of said straight members, a tracing stylus and a marking stylus respectively connected to said stylus carrying members, the stylus carrying member mounted on said first straight member being pivotally connected to said arm at the inter-section thereof with said first member, the stylus carrying member slidably mounted on said second straight member being pivotally mounted on said arm at the inter-section of the latter with said second member.

11. A drafting instrument of the character described, comprising a frame movable over a flat surface in combination with means for guiding the displacement of said frame along a straight line and without rotation comprising a shaft journalled on said frame, gear wheels keyed to said shaft, spaced parallel racks adapted to rest on said flat surface, said gear wheels meshing with said racks, said frame including a first integral straight member extending at right angles to said racks, a second straight member removably affixable to said frame in spaced parallel relationship with said integral straight member, means to affix said second member at a pre-determined varying distance from said first straight member, a pivot pin mounted on said frame at a point spaced from said two straight members, said pivot pin adjustably displaceable relatively to said frame for varying its distance from said first straight member, a straight arm engaging said pivot pin, a stylus carrying member slidably mounted on each of said straight members and pivotally connected to said arm at the inter-sections of the latter with said straight members, the stylus carrying member slidably mounted on said second straight member being slidable relatively to said arm, and a tracing stylus and a marking stylus secured to said stylus carrying members.

12. A drafting instrument of the character described, comprising a U shaped frame adapted to be disposed on a flat surface, racks mounted on the parallel spaced legs of said U shaped frame, a triangular movable frame having straight base and side members, a shaft extending parallel to said base member and journalled on said frame, gear wheels keyed to the ends of said shaft projecting from said frame and meshing with said racks, an auxiliary wheel secured to the apex portion of said triangular frame, a plurality of spaced holes made in said side members of said triangular frame, said holes opposed in pairs and the holes of each pair lying at an equal distance from said base member, a straight bar, pins projecting from said bar and slidably mounted thereon, said pins engageable with said holes of said side members to secure said bar in adjustable spaced parallel relationship with said base member, stylus carrying members slidably mounted on said base member and on said bar, interchangeable marking and tracing styli

secured to said stylus carrying members, a pivot pin mounted at the apex portion of said triangular frame, means for displacing said pivot pin relatively to said frame for varying its distance from said base member, a straight arm pivoted at one end on said pivot pin, said arm pivotally and slidably connected to said stylus carrying members.

13. A drafting instrument as claimed in claim 12, wherein said arm projects at its other end from said base member and a circular plate

secured to the free end of said arm and adapted to come into frictional contact with said flat surface.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
520,003	Lehner	May 15, 1894
1,322,592	McTaggart	Nov. 25, 1919