J. G. SPARKES.

DRAWING APPARATUS.

APPLICATION FILED DEC. 17, 1917.

1,306,861.

Patented June 17, 1919.

3 SHEETS—SHEET 1.

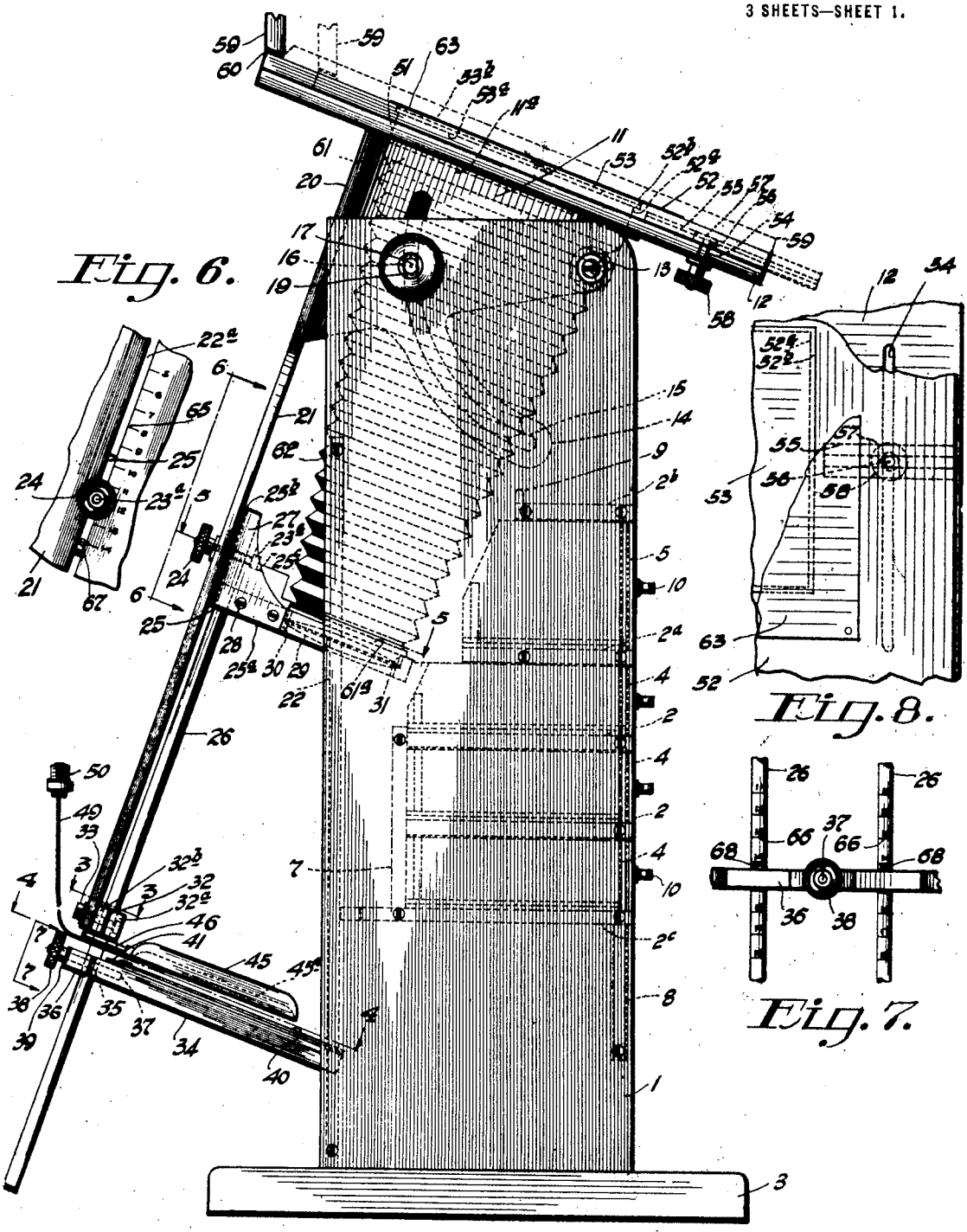


Fig. 6.

Fig. 8.

Fig. 7.

Fig. 1.

Witness

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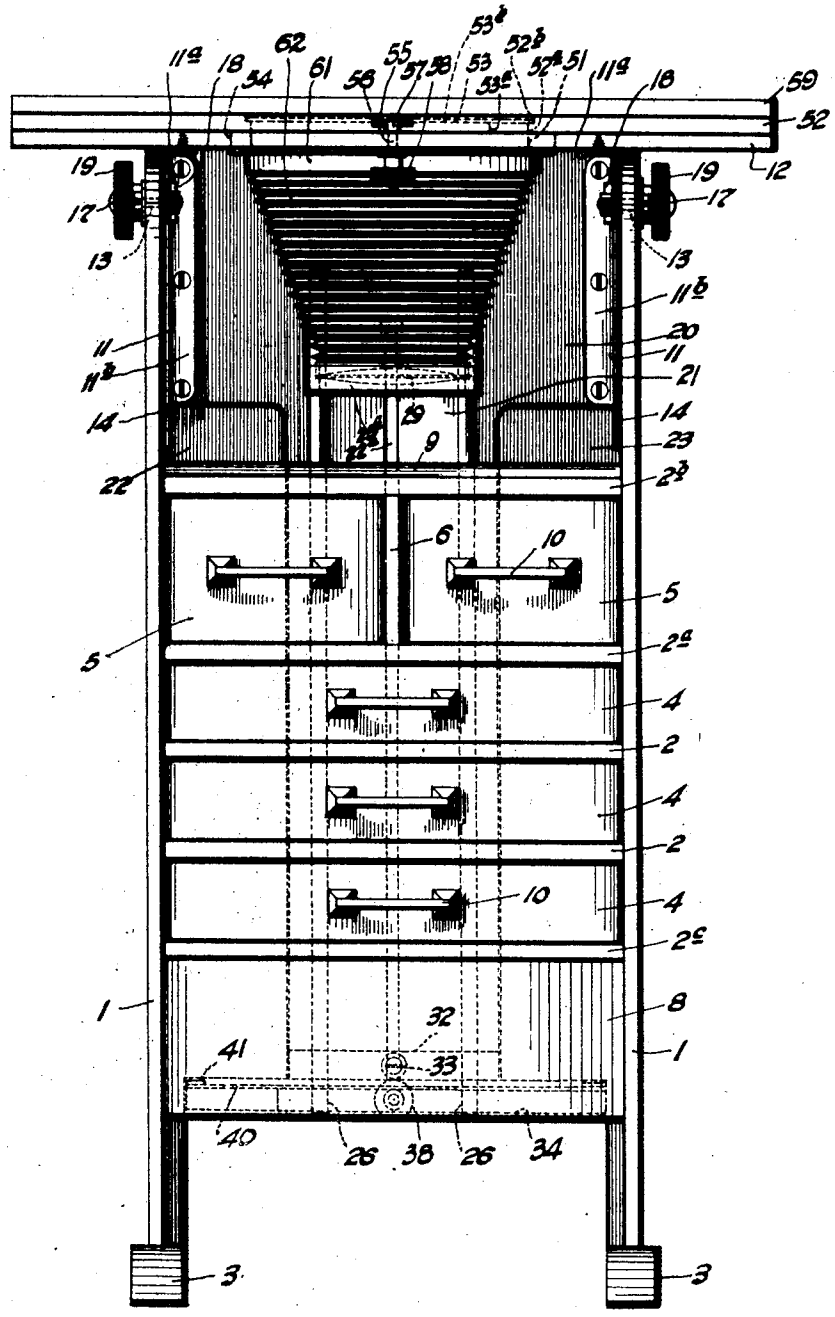


Fig. 2.

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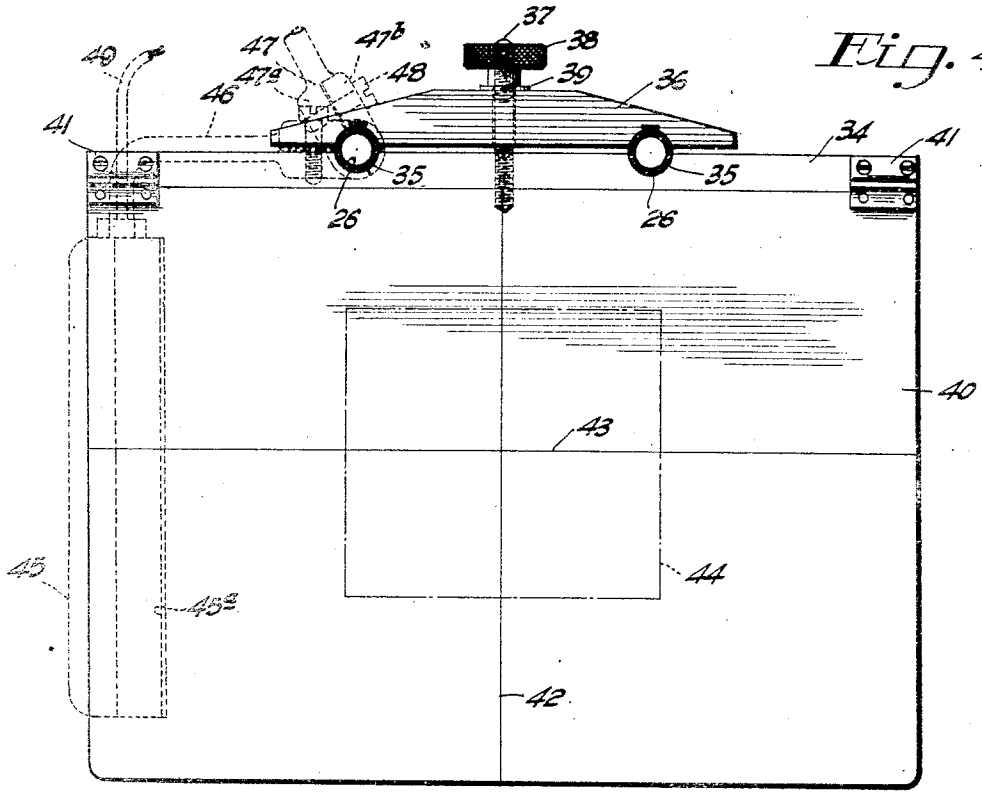


Fig. 4.

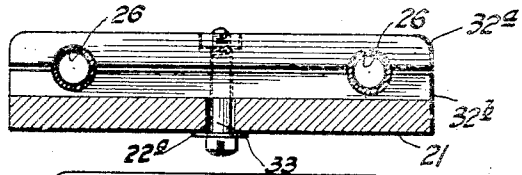


Fig. 3.

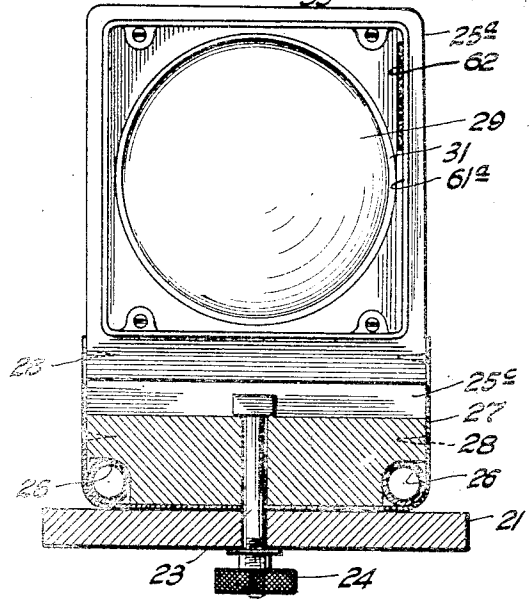


Fig. 5.

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UNITED STATES PATENT OFFICE.

JOHN GORDON SPARKES, OF BIRMINGHAM, ALABAMA.

DRAWING APPARATUS.

1,306,861. Specification of Letters Patent. Patented June 17, 1919.

Application filed December 17, 1917. Serial No. 207,597.

To all whom it may concern:

Be it known that I, JOHN GORDON SPARKES, a citizen of the United States of America, residing at Birmingham, in the county of Jefferson and State of Alabama, have invented certain new and useful Improvements in Drawing Apparatus, of which the following is a specification.

My invention relates to a drafting apparatus especially designed for use in making Patent Office drawings, technical illustrations, or for use in any branch of drawing wherein copy or reproduction work to the same size, or other sizes, than the original, or where drawing from the object itself is desired.

My invention is likewise adapted to any shadow projection sketching, such as the outline from an opaque object or the tracing of a drawing, or parts of a drawing, onto another drawing by shadow projection.

In particular, in the making of a Patent Office drawing, it often occurs that an invention is to operate in combination with some standard piece of apparatus or machine, as an attachment, and it is then necessary to select a drawing or photograph of the machine, generally from a catalogue, and copy it by a laborious process of measurement; and if the illustration is not of a convenient size to be adapted to the patent sheet the process necessitates the use of a scale or proportional dividers, both of which are laborious and tedious. Furthermore these methods are often injurious to the copy either soiling, or piercing with divider points; whereas when using this apparatus the copy is not handled.

Likewise in technical illustrations, parts of an old drawing must be worked into the new, a reduction of a large working drawing must be made, or a correct drawing must be transposed to other material. Often the perfect model of a machine or object is at hand and to make a drawing of comparatively accurate proportion requires careful measurements of more or less complication; and to make an assembled perspective view becomes a matter of free hand sketching with a total abolition of all attempts at scaled proportion of parts, and should the object require reduction or enlargement the problem becomes more complicated.

Forming exact outlines, or projections of objects is inconvenient, the matter of "tracing" as known in engineering practice is an example of this and presents certain difficulties, especially if the tracing is to be made from an old blue print or a new drawing "built up" from several old ones. This apparatus as will be understood later provides a means to pass light rays, parallel to each other by the original object and to the tracing material, thereby giving a sharp definite projection and further provides opportunity for the tracing of the outline of any opaque object by inserting it in the path of the paraxial rays.

It is the object of this invention to provide a means to conveniently and economically accomplish this work primarily but it may likewise be adapted to many other drawing operations as enlarging and reducing ornamental letters, designs, trade-marks, maps, etc.

In its preferred design, the instrument is built into a novel cabinet form, so as to provide a convenient drawing desk, embodying the image forming and projection apparatus as an integral part of the instrument. However the design used for illustration is only one specific form and it is understood that many other arrangements of details can be made without departing from the scope of the invention.

In the drawings:—

Figure 1 is a side elevation of the apparatus when open and ready for projection work.

Fig. 2 is a front elevation of the apparatus when closed.

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 1.

Fig. 4 is a plan view of the object plane looking from the line 4—4 of Fig. 1.

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 1, and shows the lens, holder and guide in elevation and section, respectively.

Fig. 6 is a plan view showing the graduations forming the scale along the slot in the lens guide, and is taken from the line 6—6 in Fig. 1.

Fig. 7 is a plan view showing the graduated positions on the object plane guides, and is taken from the line 7—7 of Fig. 1.

Fig. 8 is a plan view showing the arrangements of the adjusting slots in the top boards.

Similar reference numerals refer to similar parts throughout the drawings.

The instrument has two vertical side walls 1, held in rigid and fixed relative position by a number of spacers 2, disposed horizontally, and are raised from the floor by two bottom pieces 3, which are substantially longer than the width of the sides to provide a steady base support. The spacers 2 also act as guides for a convenient number of drawers 4 and 5, which slide between the walls 1. The drawers 4 are substantially the width of the cabinet but the drawers 5 are smaller and are spaced from each other by a partition 6, set vertically against and between the upper spacer 2^b and the next lower spacer 2^a. These spacers 2^a and 2^b are narrower than the lower spacers 2, and this will be obviously necessary for clearance of the projection apparatus, reference to which will follow. The lower spacer 2^c is extended to lap and extend beyond a back spacer 7, which is set vertically at the rear ends of spacers 2 to form a drawer stop and more particularly to prevent a movement of the sides 1 in a plane perpendicular to the spacers 2. Likewise for the same purpose the panel 8 is used under the spacer 2^c, and it also forms a closure for the lower front of the cabinet.

It will be noticed, Fig. 1, that the spacers 2^c, 7 and 8 form, when screwed together, a Z-shaped support, the spacer 2^c absolutely preventing a movement of the sides in a horizontal plane and the spacers 7 and 8 preventing movement in the vertical plane. The spacer 7 extends slightly above the spacer 2 to provide a stop for the upper drawer 4. Spacer 2^b also acts as a working shelf for pencils, pens, etc., and has a strip 9 along its rear edge to hold them. Each drawer is provided with a pull 10.

The upper part of the cabinet is left open to form a mounting for the projection apparatus and upon inturned flanges 11^a of suitable brackets 11, is mounted a supporting board 12, and by means of two pivoting bolts 13, passing through bearings in the brackets 11, this board may be tilted to any desired angle ranging from horizontal to vertical.

As the board 12 extends over both of the sides 1, it is necessary for the corners of the sides 1 to be curved concentric to the bearing bolt 13. To retain positively the board in any desired angle, the brackets are provided with quadrant arms 14 having slots 15 concentrically located to the bearing bolts 13 and passing a flattened portion 16 on clamp screws 17, passing through the walls 1 of the cabinet. The clamp screw 17 has a head 18 and a hand nut 19, which, when coacting, draw the bracket quadrant arm 14 tight against the cabinet wall 1, thereby locking or clamping the top 12 in any desired position within the range of the arm. The flattened shoulder 16 on the clamp screw 17 prevents rotation of the screw, when the hand nut 19 is turned.

The bearing bolts 13 are provided with suitable washers and nuts to permit a free rotation of the board 12, when the clamp screws 17 are released. Fastened to flanges 11^b, inturned from the brackets 11 along their rear vertical edges, is the central part of the cabinet back. This back has an upper portion 20 substantially as wide as the cabinet itself, and has just sufficient clearance to pass freely between the vertical sides 1 and to rigidly engage the brackets 11 and top board 12. At the lower extremity of the flanges 11^b the back 20 is reduced to form a guide 21.

To close the back of the cabinet on each side of the guide 21, are inserted two panels 22 and 23, leaving clearance for the free passage in and out of the swinging back 20 and 21. These back panels 22 and 23 are held in position by screws passing through the walls 1 and braced by being screwed to the extension of the spacer 2^c. The extension of the spacer 2^c is notched, or cut away to pass or receive the guide rods later referred to as 26, when they are brought into closed position.

The back 20 and 21 has cut along its longitudinal axis a slot 22^a, which guides a bolt 23^a, which may be clamped at any position by a hand nut 24. Adapted to slide on the inner face of this guide is a lens holder 25 formed preferably of a front upright portion 25^a, substantially perpendicular to the guide face, and a projecting arm 25^b parallel to the guide face. The arm 25^b is provided with a suitable hole to pass the clamp bolt 23^a, and the back is cut to form a suitable shoulder 25^c to coact with the head of the bolt so as to prevent turning of the bolt with the hand nut. The arm 25^b has cut in its guide following face two parallel holes or grooves, adapted to receive two rods 26. The ends of the rods are firmly retained in the grooves by a metal strap 27 which passes over both rods and extends up each side of the block 25 and is held in tight and fixed position by screws 28. The portion 25^a has a hole bored through it of size sufficient to retain a lens 29. The lens is held between an annular bead 30 and a ring 31 which is pressed in after the lens is in place.

It is now obvious that the block 25 carrying the lens, can by means of the bolt 23^a and the hand nut 24 be moved the entire length of the guide slot 22^a and be clamped at any position in the slot. The rods 26 extend downwardly from the block

and at the lower extremity of the guide back 21 pass through holes in a lateral clamp 32, which forms a guide for the rods and assures an absolutely parallel movement of the rods both as to the guide back 21 and to each other. This clamp 32 also serves to bind the two ends of the back guide 21, formed by the slot 22^a dividing the back 21. In order that an adjustable friction may be provided between the clamp 32 and the rods 26, the clamp is divided so as to have a clamping portion 32^a, which may close by means of a clamp screw 33, against the rods 26 and force them against the upper portion 32^b.

On the lower ends of the rods 26, projecting beyond the strip 32 is mounted an object plane, adapted to be moved to and clamped at any desired position. This plane consists of a platform 34, having grooves 35 along its upper edge to engage and when co-acting with a clamp bar 36 will grasp and clamp on the rods 26. The clamp bar is held in position by a screw 37, made fast in the platform at one end, and after passing through the clamp bar 36 is provided with a hand nut 38 and washer 39.

It will be noticed that by releasing the hand nut 38 sufficiently the bar 36 can be turned to parallelism with the rods 26 and the object plane completely removed. As the object will generally be in the form of a drawing or photograph a transparent cover 40 is hinged to the plane by hinges 41. This cover will retain the object 44 in any desired position and assure a flat smooth surface. Lines 42 and 43, scribed on the surface of the transparent cover aid in securing a central alinement of the object 44 with the optical system.

To illuminate the object an electric lamp 45^a mounted with a reflecting cover 45 is supported on a bracket 46 and clamped to the rod 26 or to the object plane 34. In the embodiment shown dotted in position in Fig. 4, the bracket bends at right angles to the longitudinal axis of the lamp and terminates in a clamp 47, which has one of its jaws 47^a integral with the bracket and the other 47^b separate but retained by a screw 48. The jaws are shaped to conform to the sections of the rods or tubes 26. By loosening the screw 48 sufficiently the jaw 47^b can be turned about the screw and the lamp removed from the rod 26.

In most cases it will be desirable to use two lamps, one on each side and each clamping its respective rod 26. It will be apparent that this construction is of peculiar advantage as the lamp and bracket can be turned about the rod 26 as a center, out from the object plane, so as to leave this plane accessible for the insertion and removal of the object. The screw 48 provides the required pressure to furnish the necessary friction between the jaws and the rod to hold the lamp in any desired position. The lamp is provided with any standard electrical connections, preferably consisting of a flexible cord 49 terminating in a plug 50. The lower part of the cabinet houses the object plane and the lamps, which fold in when the apparatus is closed. The top board 12 has an opening 51 cut through it to pass the light from the lens to an image screen support 53 set in a superimposed board 52. This board 52 has an opening 52^a and a recessed inner edge 52^b to act as a retainer for the image screen support 53. In order to permit an easy alinement of the particular space on the image screen or paper when it may be desired to project the image for the purpose of drawing, the board 52 is free to move in any direction sliding over the board 12, and after alinement and "squaring up" with the image of the object with the paper, it may be clamped by means of the hand nut 58. To make this adjustment the board 12 is provided with a through slot 54 parallel to and set in from its front edge, while the board 52 has a T slot 55 parallel to its sides and passing from the front edge toward the center and along the center line. A bolt 56 having a head 57 and hand nut 58 passes through these slots, the head 57 working freely in the T slot 55 and the hand nut 58 on the under face of the board 12. The head 57 co-acting with the hand nut 58 through the bolt 56, engages and draws the boards 12 and 52 firmly together and locks them in any desired relative position within the range of the slots. By means of these crossed slots and bolt it is apparent that the board 52 carrying the drawing paper can quickly be moved to any desired position and thereby makes alinement of the drawing paper and image simple and without the shifting of the object or the shifting of the paper by removal from the board. Also the object may always have the advantage of being in the optical axis of the lens system, thereby forming a clearer image.

The image screen support 53 is a transparent plane built up of an under rigid plate 53^a, preferably glass, and having cemented to its upper face a sheet 53^b of softer material, preferably transparent celluloid. Both of these form the image screen support and are set in the board flush so as to form a perfectly smooth surface at the image plane.

Now it will be necessary to point out that in order to form an image it is necessary to have a translucent screen interposed in the path of the light rays, but this is provided in the paper 63 upon which the drawing is to be made. If however for any reason the

paper should not be used either the glass or celluloid could have a ground surface.

To protect this image plane when not in use and for use as a drawing board when no projection is to be made, I provide an auxiliary board 59 mounted on the top board by hinges 60. This board 59 also has a function in its raised position as shown in Fig. 1; but this can better be described in the operation.

On the top board 12 and surrounding the opening 51 is a downwardly projecting reinforcement 61 which strengthens the top board 12 and also provides a fastening flange for the large end of a folding bellows 62. The forward end or the small end of the bellows is attached to the sliding lens block 25 by a smaller fastening flange 61^a. This bellows prevents any side light from entering between the lens and the image screen.

In operation, the apparatus being in closed position, as shown in Fig. 2, the hand nuts 19 are released and the boards 12 and 52 are swung upward through an angle of about 25°, moving about the center bearing bolts 13 and causing the back 20 and 21 to swing outwardly. The hand nuts are then clamped and the bolts 17 engage the quadrant 14 and lock the projecting apparatus in this position. The lamps 45 are then swung outwardly to clear the object plane.

The object in this case, assume a cut from a catalogue, is inserted on the object plane 34 and held in position by the transparent cover 40 and adjusted to center by aid of lines 42 and 43. The reduction or enlargement of the object is determined upon, preferably in tenths and by reference to a calculated table or chart the exact distance required from the center of the lens to the surface of the object and the corresponding distance from the center of the lens to the upper surface of the translucent image screen can be found and the lens and object plane set and clamped in these positions. The most convenient manner however is shown in Figs. 6 and 7 and here the distances are marked off and denoted in tenths magnification. Suppose, for sake of illustration, that the image is to be shown of magnification one and four-tenths actual size of object or as shown on the scale 65, Fig. 6, and 66, Fig. 7, fourteen-tenths. The hand nut 24 is released and the lens block 25 is moved until its indicator 67 is at the graduation fourteen-tenths and clamped. This operation sets the lens at the proper distance from the image screen. The clamp nut 38 is now released and the object is moved by sliding the object plane until the indicator 68 is at the position of the graduation 14 on the rod 26, and clamped. It will be noted that the distances from the center of the lens to the graduation on the rod will never change as the ends of the rods are rigidly clamped in the block 25 and move with it.

The distances having been set, the auxiliary board 59 is turned up to expose the transparent image screen support. The drawing paper is fastened over this and the screen alined with the central point of location of the proposed drawing on the paper. The light is then turned on, preferably by a switch convenient to the operator and through the plug 50 and suitable connections to the lighting circuit. The light emitted from the lamp brightly illuminates the object and the rays pass upward along the optical axis to the lens where they are refracted to form the image at the image screen.

Now the auxiliary board 59 serves as a screen to exclude light to a practical extent from the image screen and by its shadow permits a more apparent contrast of line and field on the image screen. To pass paraxial rays to the drafting surface it is only necessary to set the lamp at the focal point of the lens. The operator can now proceed to make the drawing, using any required instruments. The image furnishes the outline and the operator has been relieved of any measuring or scaling and may draw direct upon the paper, often times in ink.

The image screen support plane is built up as previously described with a soft material over the rigid, so that in mechanical work the points of compasses may find a firm setting and without danger of turning or blunting the sharp point.

It will likewise be noted that the image is erect and not perverted. To correct the ordinary inversion it is necessary to insert the object inverted but perversion is corrected by the fact that the rays actually pass through the paper (translucent screen) before the drawing is made.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. A drawing apparatus comprising an optical system, a drafting surface disposed on one side thereof, an object plane on the other side; centering lines intersecting at the optical axis of the said system, and disposed between said optical system and said object plane and adapted to be projected with the object onto said drafting surface.

2. A drawing apparatus comprising an optical system, an adjustable drafting surface disposed on one side thereof, an object plane on the other side; centering lines intersecting at the optical axis of the said system, and disposed between said optical system and said object plane, and adapted to be projected with the object onto said drafting surface.

3. A drawing apparatus comprising an optical system, an adjustable translucent

screen on one side thereof, an object plane on the other side; centering lines intersecting at the optical axis of the said system, and disposed between said optical system and said object plane, and adapted to be projected with the object onto said drafting surface.

4. A drawing apparatus comprising a support plane for an optical system, said system being adjustable along the longitudinal axis of the said plane; an adjustable translucent drafting screen set substantially perpendicular at one end thereof, an object plane adjustable along the optical axis, a transparent sheet having centering lines scribed thereon interposed between said optical system and said object plane and adapted to be projected with the object upon said translucent drafting screen.

5. A drawing desk having side walls spaced from each other and braced by a plurality of spacers set substantially horizontally and vertically, a plurality of drawers interposed between said spacers and walls, a translucent drafting surface pivotally mounted on said walls, and a projection apparatus carried by said drafting surface, said drawers being arranged to form a recess to receive said projection apparatus, and means to hold said drafting surface in adjusted position.

6. In a drawing apparatus, a cabinet, a hinged support means thereon carrying a translucent screen and a projection apparatus adapted to project an image on said screen, and a rearwardly opening recess in said cabinet into which said projection apparatus swings and is housed when said screen is in normal position.

7. A drawing apparatus comprising a guide plane, a translucent screen set at right angles to said plane and at one end thereof, a mounting carrying an optical system adjustable along the longitudinal axis of said plane, guide rods fixed at one end to the said mounting and movable therewith, guide means on said guide plane to engage and guide said rods, an object plane adjustable on said rods, and means to illuminate said object plane.

8. A drawing apparatus comprising a guide plane, an adjustable translucent screen set at right angles to said plane and at one end thereof, a mounting carrying an optical system adjustable along the longitudinal axis of said plane, guide rods fixed at one end to the said mounting and movable therewith, guide means on said guide plane to engage and guide said rods, an object plane adjustable on said rods, and means to illuminate said object plane.

9. A drawing apparatus comprising a guide plane, an adjustable translucent screen set at right angles to said plane and at one end thereof, a mounting carrying an optical system adjustable along the longitudinal axis of said plane, guide rods fixed at one end to the said mounting and movable therewith, guide means on said guide plane to engage and guide said rods, an object plane adjustable on said rods, means to illuminate said object plane, and graduations on said guide plane and said guide rods adapted to co-act with indicators on said mounting and said object plane to indicate predetermined magnification.

10. A drawing apparatus comprising a guide plane, an adjustable translucent screen set at right angles to said plane and at one end thereof, a mounting carrying an optical system adjustable along the longitudinal axis of said plane, guide rods fixed at one end to the said mounting and movable therewith, guide means on said guide plane to engage and guide said rods, an object plane adjustable on said rods, illuminating means for said object plane adjustably mounted on said rods, and graduations on said guide plane and said guide rods adapted to co-act with indicators on said mounting and said object plane to indicate predetermined magnification.

11. In combination with a projection apparatus, a supporting plane set substantially at right angles to the optical axis of said projection apparatus, a plane superimposed on said supporting plane having a transparent plane set in an opening therein, and an adjusting and clamping means to permit the adjustment of said transparent plane and the clamping of said planes in position.

12. A drawing desk having side walls spaced from each other and braced by a plurality of spacers set substantially horizontally and vertically, a plurality of drawers interposed between said spacers and walls, an adjustable translucent drafting surface pivotally mounted on said walls, and a projection apparatus comprising a guide plane set substantially at right angles to said translucent drafting surface, a lens system adjustable along said guide plane, a folding bellows interposed between said translucent drafting surface and said lens system, guide rods fixed at one end to the said lens system and movable therewith, guide means on said guide plane to engage and guide said rods, an object plane adjustable along said rods, and means to illuminate said object plane, said drawers being arranged to form a recess to receive said projection apparatus, and means to hold said drafting surface in adjusted position.

13. A drawing desk having side walls spaced from each other and braced by a plurality of spacers set substantially horizontally and vertically, a plurality of drawers interposed between said spacers and walls, an adjustable translucent drafting surface

pivotally mounted on said walls, and a projection apparatus comprising a guide plane set substantially at right angles to said translucent drafting surface, a lens system adjustable along said guide plane, a folding bellows interposed between said translucent drafting surface and said lens system, guide rods fixed at one end to the said lens system and movable therewith, guide means on said guide plane to engage and guide said rods, an object plane adjustable along said rods and means to illuminate said object plane, graduations on said guide plane and said guide rods to indicate the proper positions of said lens system and said object plane, respectively, to form an image of predetermined magnification, said drawers being arranged to form a recess to receive said projection apparatus, and means to hold said drafting surface in adjusted position.

In testimony whereof I affix my signature.

JOHN GORDON SPARKES.

Witness:

NOMIE WELSH.