

Oct. 20, 1931.

J. H. EMERSON

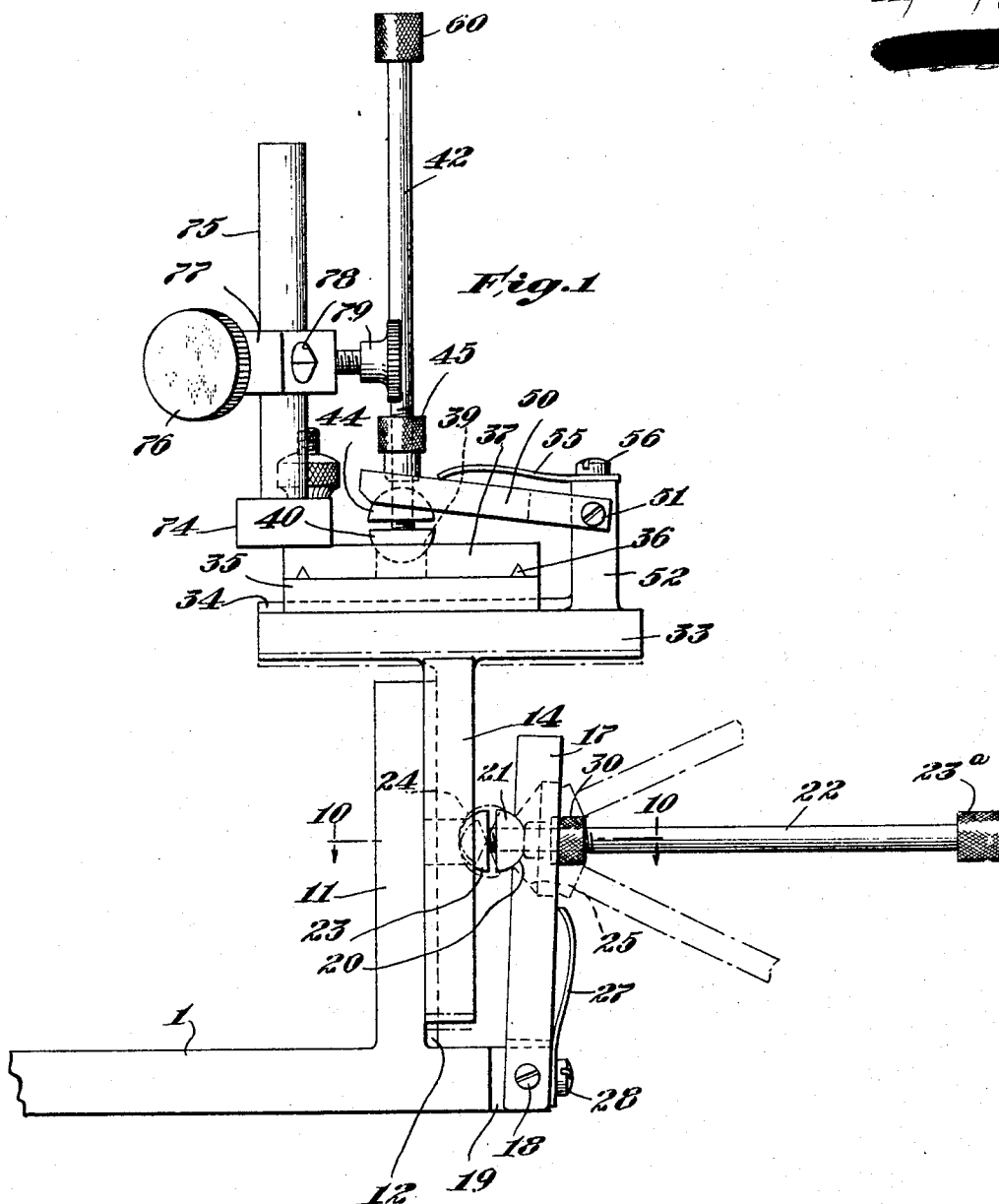
1,828,460

MICRO MANIPULATOR

Filed Sept. 9, 1930

3 Sheets-Sheet 1

*1750 microscope
Inventor's drawing.*



Inventor
John H. Emerson
by Philip C. Caseman & Associates
Attys.

Oct. 20, 1931.

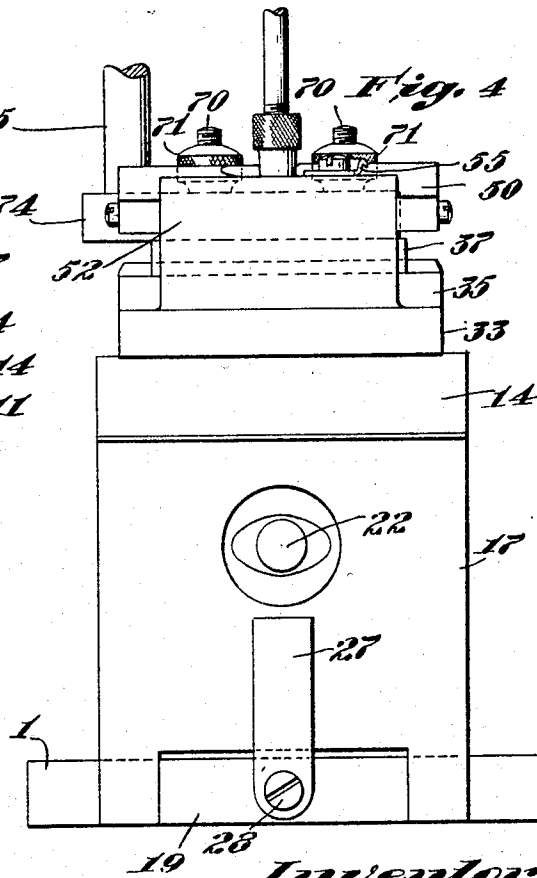
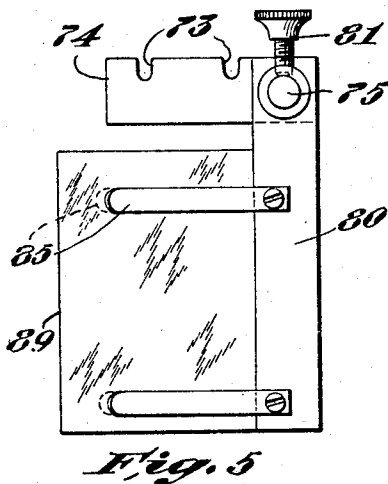
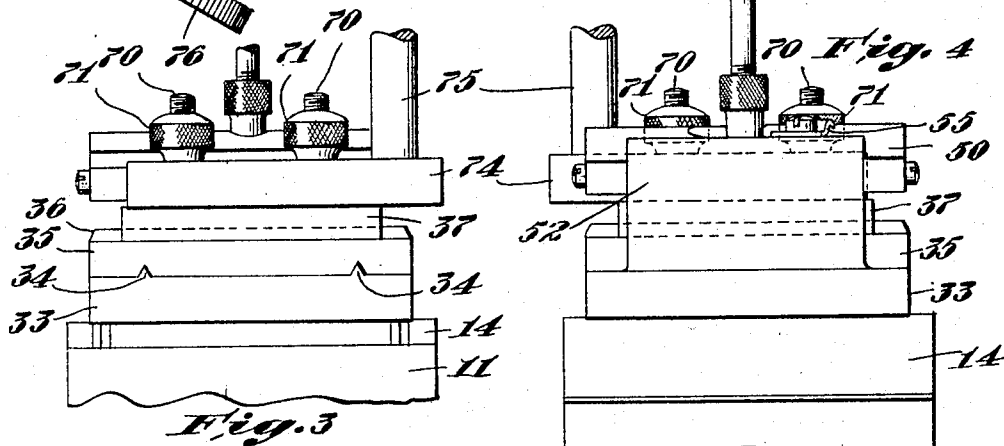
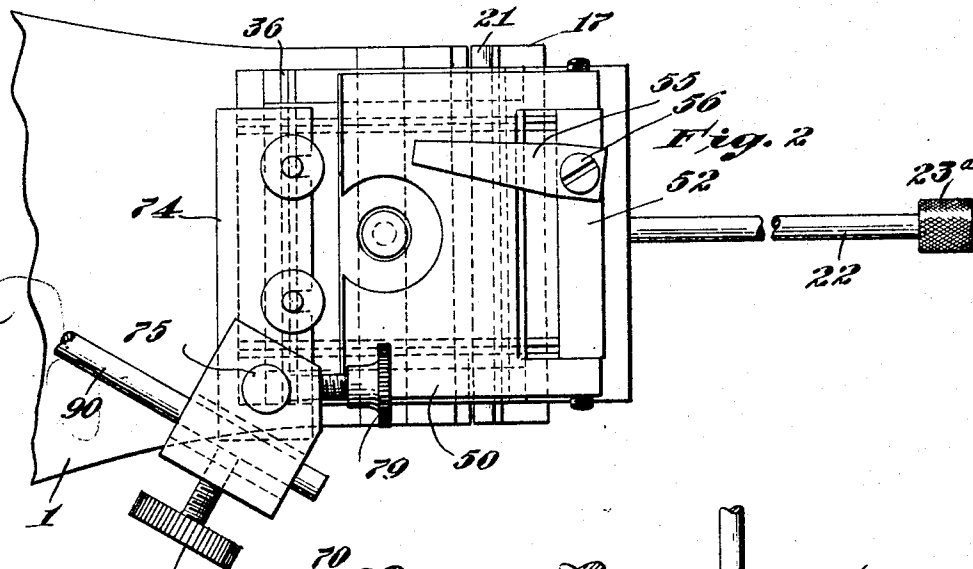
J. H. EMERSON

1,828,460

MICRO MANIPULATOR

Filed Sept. 9, 1930

3 Sheets-Sheet 2



Inventor
John H. Emerson
by Robert Cushman & Co.
Attys.

Oct. 20, 1931.

J. H. EMERSON

1,828,460

MICRO MANIPULATOR

Filed Sept. 9, 1930

3 Sheets-Sheet 3

Fig. 6

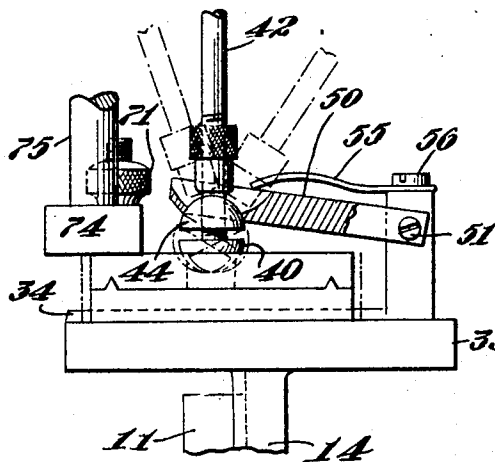


Fig. 7

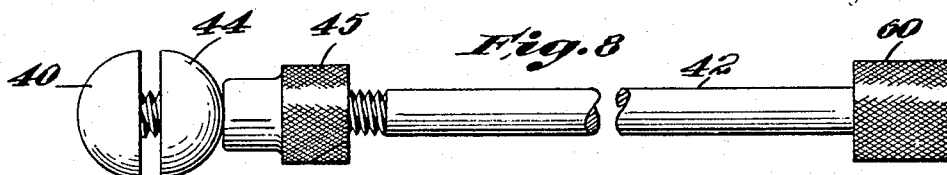
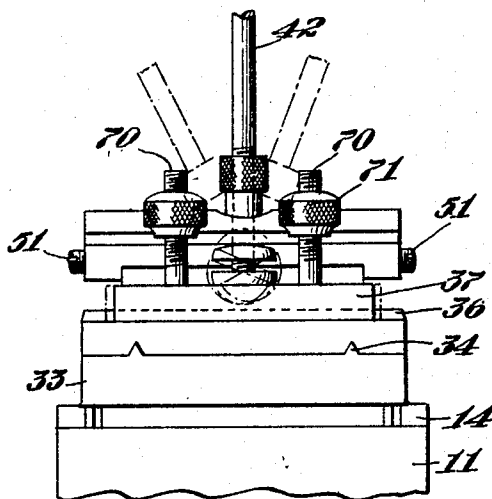


Fig. 8

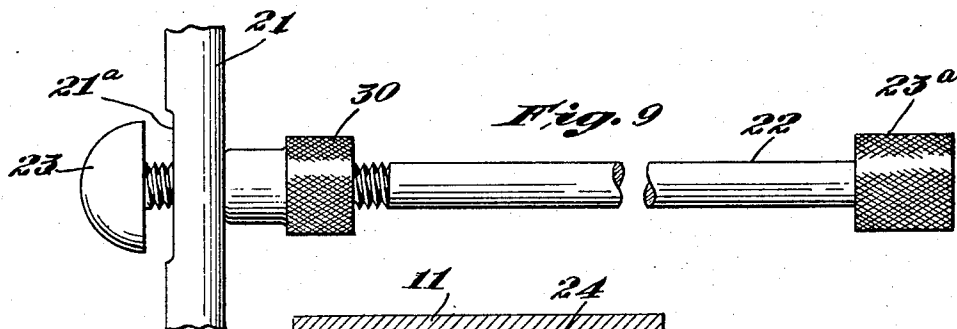


Fig. 9

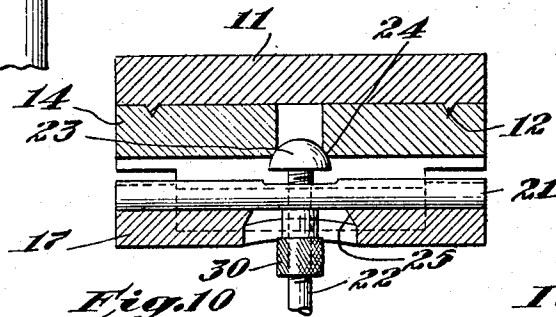


Fig. 10

Inventor
John H. Emerson
by Robert Cushman & Company
Attys.

40
Patented Oct. 20, 1931

Search Room
1,828,460

UNITED STATES PATENT OFFICE

JOHN H. EMERSON, OF CAMBRIDGE, MASSACHUSETTS

MICRO-MANIPULATOR

Application filed September 9, 1930. Serial No. 480,635.

This invention relates to adjustable holders or manipulators, and particularly to devices of this character which are adapted to move and accurately position an element within a very small region.

5 This invention is particularly applicable to devices known as micro-manipulators which are employed to position a dissecting needle or micro-pipette in any desired position in the field of a high-powered micro-
10 scope. Furthermore, a micro-manipulator of this character is also adapted readily to effect a proper positioning or movement of a slide in relation to the field of vision of a
15 microscope.

Heretofore, relatively complicated micro-manipulators have been provided which have been characterized by springs, a multiplicity of adjusting screws, etc., which have resulted in a discernible lack of smoothness in
20 operation, and which have been rather troublesome to use due to the multiplicity of controls, this factor also making it rather difficult for a user to learn how to manipulate
25 one of these devices.

The present invention provides a simple arrangement of moving parts, neither screws, springs, nor gears being primarily relied upon in the positioning of elements. A particularly advantageous feature of the preferred embodiment of the invention resides in the fact that a single control member may be employed to move the controlled element, such as the micro-pipette or slide, in any direction in a given plane, such as a horizontal
30 plane, a second control being provided to move the controlled part in a direction at right angles thereto, as in a vertical direction. Preferably, the control handle which
35 regulates the horizontal movement of the needle, slide, or the like, is moved in a direction opposite to the movement of the controlled element itself, so that as seen under the microscope, the element has the same direction of
40 movement as the control handle. Accordingly, a device of this character may be operated very readily without previous experience upon the part of the user.

Another advantageous feature of a device
50 of this character is its ready adjustability

for employment under relatively low and relatively high powered microscopes. A simple adjustment which may be associated with the control handle permits an immediate change in the ratio between the amount of movement of the control handle and of the controlled element, which ratio may be varied within very wide limits. An apparatus of this character may be employed with attachments which are adapted to permit the manipulation of a dissecting needle, a pipette, or of a movable slide. Apparatus of this character may be made of a relatively small number of sturdy parts and at a comparatively low cost of manufacture, and is particularly characterized by being free from small, delicate, complicated parts which are expensive and are difficult to maintain in operating adjustment.

In the accompanying drawings:

Fig. 1 is an elevational view of a preferred embodiment of the invention;

Fig. 2 is a top view of the same;

Fig. 3 is an end view of a portion of the mechanism which is particularly adapted to control the positioning of an element in one plane, as a horizontal plane;

Fig. 4 is an end elevation of the apparatus, certain parts being broken away;

Fig. 5 is a plan view of the supporting parts for a slide which may be connected to the apparatus;

Fig. 6 is a view, partly in elevation and partly in section, of the means for adjusting the element in a horizontal plane;

Fig. 7 is an elevational view of the assembly shown in Fig. 6;

Fig. 8 is a view of one control handle and related parts;

Fig. 9 is a similar view of the other control handle and related parts; and

Fig. 10 is a section on line 10—10 of Fig. 1.

Referring to the accompanying drawings, and first more particularly to Fig. 1, apparatus of this character preferably is provided with any suitable support, such as the planar base 1, which may also form the base for the microscope and microscope stage. Base 1 is provided with a vertically disposed flange or wall portion 11, which is spaced from one

end of the base and which preferably may have a pair of parallel, vertically extending V-shaped ribs 12 which engage complementarily shaped grooves in a plate 14, thus affording means to guide the plate 14 in a vertical path (Fig. 10). A socket plate 17 preferably is pivotally connected by pintle elements 18 to an extension 19 of the base 1 and provides a socket groove 20 which engages a substantially semi-cylindrical nut 21 that is threaded upon the inner end of a control handle 22. A countersunk opening 25 is provided in alignment with the groove 20 and permits the angular movement of control handle 22 in relation to the plate. A semi-spherical head 23 is secured to the inner end of this handle and engages a suitable seat 24 in plate 14. A spring 27 is pivotally connected to base extension 19 by a screw 28 and urges the grooved plate 17 against the nut 21, thereby frictionally engaging the same and holding the plate 14 in firm engagement with the V-shaped ribs upon the plate 11. The semi-cylindrical element 21 thus provides a pivot center about which the handle 22 may swing to vary the vertical positioning of the plate 14 in relation to plate 11; the semi-spherical head 23 similarly provides a pivot center for the lever and vertically movable plate 14; these pivot centers may be closely spaced so that the plate 14 moves through a vertical path which has a length that is but a very small fraction of that through which the outer end of handle 22 moves. A suitable lock nut 30 may be disposed upon the threaded inner end of the handle 22 to permit the locking of the same in relation to the semi-cylindrical nut 21 (Fig. 9). It is evident that the outer end of the handle 22 is provided with a knurled head portion 23^a which allows the ready rotation of the handle to permit the adjustment of the semi-spherical end 23 in relation to the semi-cylindrical nut 21, thereby varying the leverage with which the handle is adapted to effect the movement of the plate 14. Obviously as the members 21 and 23 are brought into closer juxtaposition, for example, when the plane face of element 23 substantially engages the recess 21^a in the element 21, this leverage will become smaller until almost infinitely small movement of the plate 14 results from the movement of the handle 22 through a comparatively wide range.

A horizontal planar element or plate 33 is secured to the upper end of the vertically movable plate 14 and is provided with a pair of V-shaped ribs 34 which engage complementarily shaped grooves in the bottom of a horizontally slidable plate 35; the latter in turn is provided with a pair of V-shaped ribs 36 which extend at right angles to ribs 34 and engage grooves in the bottom of a third horizontally positioned plate 37. Plate 37

preferably has a central socket or seat 39 which engages a semi-spherical element 40 secured to the lower end of a control handle 42. This handle adjoining member 40 is threaded and carries a semi-spherical nut 44 and a lock nut 45 (Fig. 8).

A socket plate 50 is pivotally connected by pintle elements 51 to an upwardly projecting lug 52 at one end of plate 33. A spring 55 may be pivotally connected, as by screw 56, to the upper part of the extension 52, its end portion holding the socket plate 50 in firm engagement with the semi-spherical nut 44. The upper end of the handle 42 is provided with a knurled enlargement designated by numeral 60, to permit the ready rotation of a handle. Spring 55 holds the plate 50 in such firm engagement with the nut 44 that rotation of the nut in response to rotation of handle 42 is prevented unless the two semi-spherical elements 44 and 40 are in engagement with each other, or unless the lock nut 45 prevents relative movement between the handle and nut 44. Accordingly, when the lock nut 45 is loosened the spacing of the elements 40 and 44 may be readily varied so that the leverage exerted by the control member 42 upon the plate 37 may be altered. In other words, the semi-spherical elements 40 and 44 define pivot centers between the handle and the plates 37 and 50 respectively, the spacing of these centers determining the range of movement of plate 37 in response to the movement of handle 42.

The plate 37 is provided with a pair of upwardly extending studs 70, Figs. 3 and 4, which may receive thumb screws 71, and may engage slots 73 at the side of a bracket bar 74; the latter carries an upstanding stud or post 75 which may engage any suitable means to receive a needle, pipette or slide holder. Thus, as shown in Figs. 1 and 2, a set screw 79 secures a block 77 in proper adjusted relation to the post 75, the block 77 having a suitable socket 78 and cooperating set screw 76 to receive and clamp the end of the needle 90 in place. As shown in Fig. 5, a bar 80 may be clamped by a thumb screw 81 to the post 75 and may carry fingers 84 which are adapted to support a suitable slide 89 of glass or the like. It is thus evident that the apparatus is adapted to be quickly adjusted either to support a needle or a suitable slide.

As shown, for example in Fig. 10, the sockets which engage the semi-spherical elements in apparatus of this character may be formed by providing a comparatively narrow seat around the edge of a hole extending through the corresponding block or plate. The plates employed in apparatus of this character may be formed of a fairly soft metal, such as brass, and the semi-spherical seats may be made by first drilling a hole at the desired point, and then shaping the edge

1,828,460

3

of the hole with a cutter to provide the curved seat.

In the operation of a device of this character, the element being controlled or moved is connected to the posts 75 upon the plate 37 by any suitable bracket, such as that illustrated in Figs. 1 and 2 or that illustrated in Fig. 5. Obviously the connection of the supporting bracket, such as the block 77 or arm 80 with the post 75, permits the first approximate positioning of the element. The handle 23 is then moved vertically to position the element in the desired horizontal plane. The handle 60 may then be swung in any desired direction to move the element in the horizontal plane in a direction corresponding to the direction of handle movement but opposite thereto. Since, however, the relative position of elements under a microscope is reversed, the handle is moved in the direction in which the element appears to move as seen under the microscope. It is particularly worthy of notice that the adjustments provided by the nuts engaging the threaded portions of the control handles permit a very wide variation in the range of movement which may be imparted to the control element. Obviously as the handle 23 is swung in a vertical direction, i. e., between the positions indicated in dot and dash lines in Fig. 1, the plate 12 moves vertically, thus moving the whole upper portion of the mechanism, including plates 33, 35, 37, bar 74, post 75 and the element connected thereto. On the other hand, the horizontal movement which is imposed by the handle 42 may cause the sliding of the plate 35 in relation to the plate 33 and/or the sliding of the plate 37 in a direction at right angles thereto; thus the movement of the handle 60 in any direction results in a substantially similar movement in an opposite direction of the plate 37 and the controlled element carried thereby. The springs 27 and 55 are pivotally mounted so that they may be swung about their pivots readily to vary the force with which the corresponding plates are held against the nuts 44 and 21 respectively.

It is evident that apparatus of this character may be manufactured at a comparatively low cost, that it is formed of sturdy parts which do not require delicate adjustment, and that the device is very simple to operate; for example, when an adjustment in both vertical and horizontal directions is desired, either one or both hands may be employed to control the handles 22 and 42 respectively, while if only horizontal positioning of the element is required, but one hand is used to impart any desired horizontal movement in a natural manner.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all

modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. Apparatus of the class described comprising a swinging lever, an element holder, a support for the holder, a part providing a pivot about which the lever swings, and a pivotal connection between the lever and support, said pivot and pivotal connection being in close juxtaposition, whereby the support and holder have a minute movement in response to the lever movement through a substantial distance.

2. Apparatus of the class described comprising a swinging lever, a socket plate, a part at the inner end of the lever providing a spherical surface in engagement with said plate, a support, said support having a part in engagement with a spherical surface adjoining said first-named surface, whereby the movement of the lever end in one direction causes much smaller movement of the holder.

3. Apparatus of the class described comprising a guide part, a movable part slidable in relation to the guide part, a socket in said movable part, a socket plate having a socket yieldably urged toward said socket in the movable part, a swinging lever, said lever having parts providing curved surfaces in engagement with said sockets and defining juxtaposed pivot centers, whereby the movable part has a minute movement in response to a substantial movement of the lever.

4. Apparatus of the class described comprising a guide part, a movable part slidable in relation to the guide part, a socket in said movable part, a socket plate connected to the guide part and having a socket yieldably urged toward said socket in the movable part, a swinging lever, said lever having parts providing substantially semi-spherical surfaces in engagement with said sockets, and defining juxtaposed pivot centers, whereby the movable part has a minute movement in response to a substantial movement of the lever.

5. Apparatus of the class described comprising a guide part, a movable part slidable in relation to the guide part, a swinging lever having an end portion providing a curved surface and engaging a complementarily formed recess in the movable part, said surface defining a pivot center at the end of the lever, an element associated with said lever and providing an oppositely curved surface defining a pivot center slightly spaced from said first center, and a socket plate connected to the guide part and yieldably engaging said lever element.

6. Apparatus of the class described comprising a guide part, a movable part slidable in relation to the guide part, a swinging lever having an end portion providing a curved surface and engaging a complementarily formed recess in the movable part said surface defining a pivot center at the end of

the lever, an element associated with said lever and providing an oppositely curved surface defining a pivot center slightly spaced from said first center, and a movable socket plate connected to the fixed part and yieldably engaging said lever element, said element having a threaded engagement with the lever, whereby the spacing of the centers may be adjustably varied.

7. Apparatus of the class described comprising a guide part, a movable part slidable in relation to the guide part, a swinging lever having an end portion providing a substantially semi-spherical curved surface and engaging a complementarily formed recess in the movable part, said surface defining a pivot center at the end of the lever, an element associated with said lever and providing an oppositely substantially semi-spherical curved surface defining a pivot center slightly spaced from said first center, and a socket plate connected to the guide part and yieldably engaging said element.

8. Apparatus of the class described comprising a guide part, a juxtaposed movable part, the latter being movable in a plane, a socket plate having a socket, said movable part also being provided with a socket, a lever having elements providing curved surfaces engaging the sockets and defining juxtaposed pivot centers, a plate connected to the movable part, a second movable part, a lever, and a socket plate associated with said plate.

9. Apparatus of the class described, comprising an element holder, a movable support for the holder, and manipulating means to effect the minute movement and precise positioning of said support and holder, said means including a swinging lever and means whereby the lever effects movement of the support in any direction within a plane in response to the lever movement in the opposite direction.

10. Apparatus of the class described, comprising an element holder, a movable support for the holder, and manipulating means to effect the minute movement and positioning of said support and holder, said means including a swinging lever and means whereby the lever effects movement of the support in any direction within a plane in response to the lever movement in the opposite direction, and a second lever and manipulating means associated with said second lever for causing the movement of said support and holder in a direction normal to said plane, whereby the holder may be moved in any direction by movement of the two levers.

11. Apparatus of the class described, comprising a part, a plate slidably mounted in relation to said part, a guide groove and rib defining the path of movement of said plate in relation to said part, a second plate superposed on said plate, a guide groove and rib defining the path of movement of the second

plate upon the first plate, said grooves and ribs extending in directions at right angles to each other but in parallel planes, a swinging socket plate connected to said part, a lever having a substantially semi-spherical element engaging a socket in said plate and defining a pivot center, a second element on the lever providing a substantially semi-spherical surface engaging a socket in the second plate, and defining a pivot center slightly spaced from said first-named center, and an element holder mounted on said second plate, whereby movement of said lever causes slight movement of the second plate and holder in a corresponding but opposite direction.

12. Apparatus of the class described comprising a guide part, a movable part, a socket plate having a pivotal connection with the guide part, a spring secured to the latter and engaging the plate, and a control lever extending through an opening in the socket plate, a semi-spherical element secured to the lever end and engaging a socket in the movable part, a second element upon the lever having a curved surface engaging a socket in the socket plate, said elements providing pivot centers in close juxtaposition, the spring holding the elements in engagement with their respective sockets.

13. Apparatus of the class described comprising a guide part, a movable part, a socket plate having a pivotal connection with the guide part, a spring secured to the latter and engaging the plate, and a control lever extending through an opening in the socket plate, a semi-spherical element secured to the lever end and engaging a socket in the movable part, a nut in threaded engagement with the lever and having a semi-spherical surface engaging a socket in the plate, said element and nut providing pivot centers in close juxtaposition, the spring holding the elements in engagement with their respective sockets and holding the nut against rotation with the lever when the latter is rotated, whereby the spacing of the pivot centers may be readily varied by rotating the lever.

14. Apparatus of the class described comprising a guide part, a movable part, a socket plate having a pivotal connection with the guide part, a spring pivotally connected to the guide part and having an end engaging the plate, the spring being movable about its pivotal connection to vary the force with which it engages the plate, and a control lever extending through an opening in the socket plate, a semi-spherical element secured to the lever end and engaging a socket in the movable part, a second element having a curved surface engaging a socket in the socket plate, said elements providing pivot centers in close juxtaposition, the spring holding the elements in engagement with their respective sockets.

15. Apparatus of the class described com-

1,828,460

5

prising an element holder, positioning means for moving the holder in any direction within a given plane, and a second positioning means to vary the position of said plane, each of said positioning means having a single control lever with a pair of curved surface elements defining juxtaposed pivot centers, a socket plate providing a relatively fixed fulcrum part for one of said elements of each pair, and a movable part having a socket engaging the other of said elements, the relatively fixed part of one of said means being mounted upon the movable part of the other means, and the holder being mounted upon the movable part of said second means.

16. Apparatus of the class described comprising a fixed part, a movable plate, said plate and part having tongue and groove means defining a vertical path for the movable plate, an element holder connected to said plate, a swinging socket member connected to the fixed part, a spring connected to said part and tending to swing said member toward the plate, a control lever extending through the socket member, said lever carrying oppositely curved elements engaging sockets in the plate and member and defining juxtaposed pivot centers.

17. Apparatus of the class described comprising a lower support, a plate slidable on said support, a tongue and groove means provided by the support and plate whereby the latter is constrained to slide in one direction, a second plate superposed on the first plate and constrained by a second tongue and groove means to have a sliding movement in relation to the first plate at right angles to the direction of the first plate movement, a socket plate pivotally connected to said support and overhanging the second plate, a control lever extending through said socket plate and carrying substantially semi-spherical elements defining juxtaposed pivot centers and engaging sockets in the second plate and socket plate, a spring pressing the latter against the corresponding element, and a holder for a part to be positioned, said holder being mounted on the second plate, whereby the lever may be swung to vary the positioning of the part in a plane.

18. Apparatus of the class described comprising a lower support, a plate slidable on said support, a tongue and groove means provided by the support and plate whereby the latter is constrained to slide in one direction, a second plate superposed on the first plate and constrained by a second tongue and groove means to have a sliding movement in relation to the first plate at right angles to the direction of the first plate movement, a socket plate pivotally connected to said support and overhanging the second plate, a control lever extending through said socket plate and carrying substantially semi-spherical elements defining juxtaposed pivot cen-

ters and engaging sockets in the second plate and socket plate, a spring pressing the latter against the corresponding element, a holder mounted on the second plate, whereby the lever may be swung to vary the positioning of the part in a plane, and means for positioning the lower support vertically, whereby universal movement of the part may be attained.

19. Apparatus of the class described comprising a lower support, a plate slidable on said support, a tongue and groove means provided by the support and plate whereby the latter is constrained to slide in one direction, a second plate superposed on the first plate and constrained by a second tongue and groove means to have a sliding movement in relation to the first plate at right angles to the direction of the first plate movement, a socket plate pivotally connected to said support and overhanging the second plate, a control lever extending through said socket plate and carrying substantially semi-spherical elements defining juxtaposed pivot centers and engaging sockets in the second plate and socket plate, a spring pressing the latter against the corresponding element, a holder mounted on the second plate, whereby the lever may be swung to vary the positioning of the part in a plane, one of said elements upon the lever being fixed against longitudinal movement in relation to the lever, the other having a threaded adjustment along the lever whereby the spacing of the pivot centers and consequent range of movement of the part in response to handle movement may be varied.

Signed by me at Boston, Massachusetts, this third day of September, 1930.

J. H. EMERSON.