No. 893,957. PATENTED JULY 21, 1908.

R. L. WATKINS.

MECHANICAL STAGE FOR MICROSCOPES AND THE LIKE.

APPLICATION FILED NOV. 11, 1907. 2 SHEETS—SHEET 1.

Fig. 1.

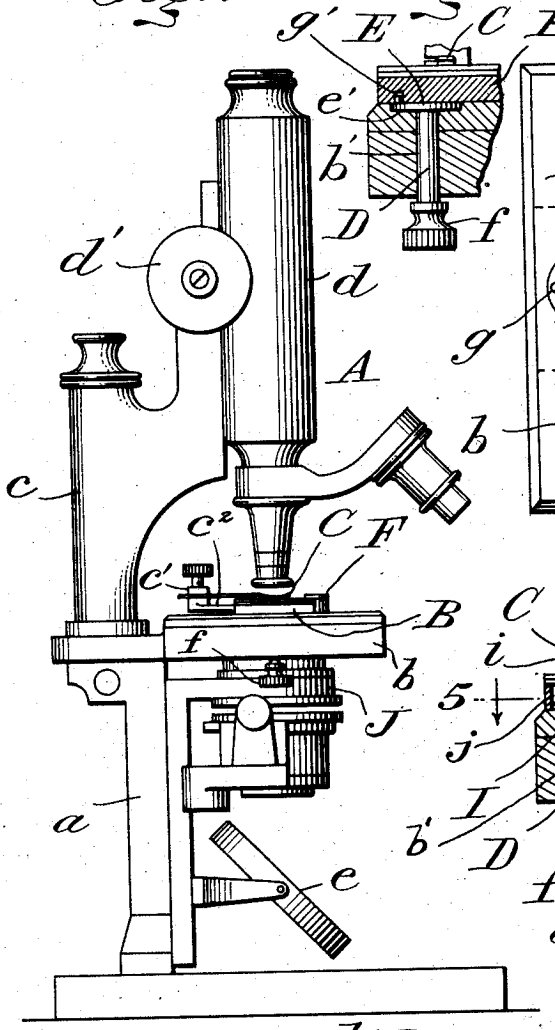


Fig. 3.

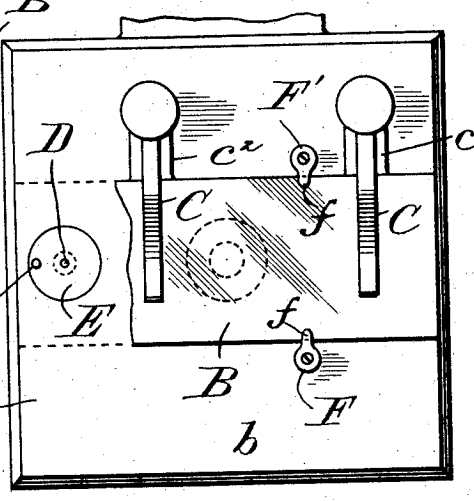


Fig. 2.

Fig. 4.

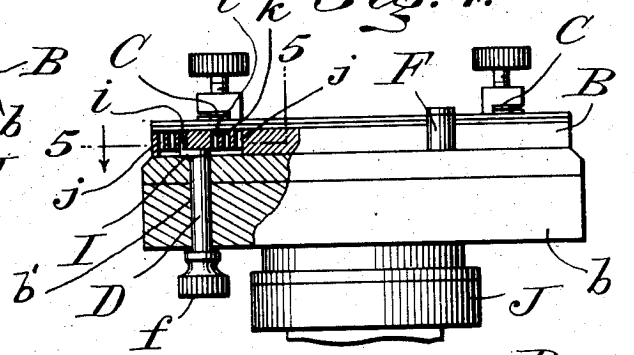


Fig. 5.

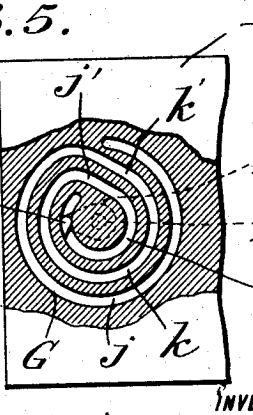
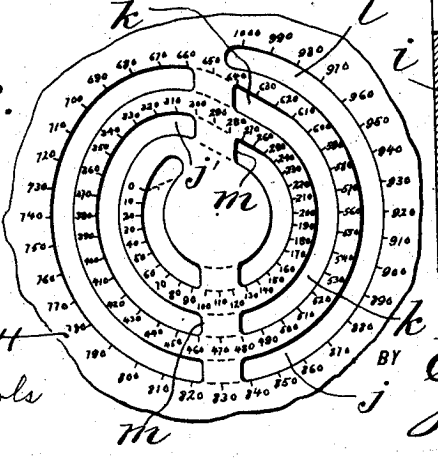


Fig. 6.



WITNESSES

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No. 893,957. PATENTED JULY 21, 1908.

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MECHANICAL STAGE FOR MICROSCOPES AND THE LIKE.

APPLICATION FILED NOV. 11, 1907. 2 SHEETS—SHEET 2.

Fig. 7.

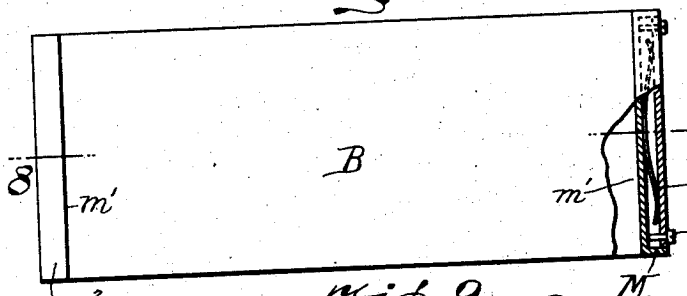


Fig. 8.

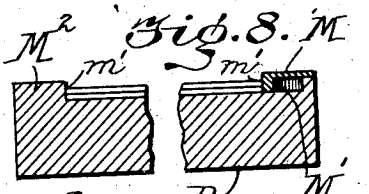


Fig. 9.

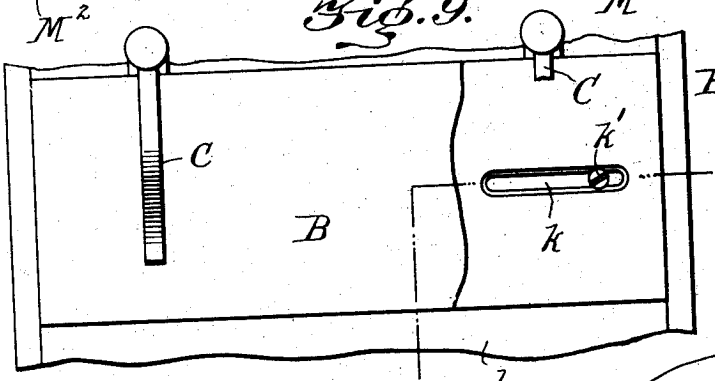


Fig. 10.

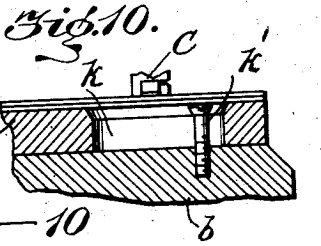


Fig. 12.

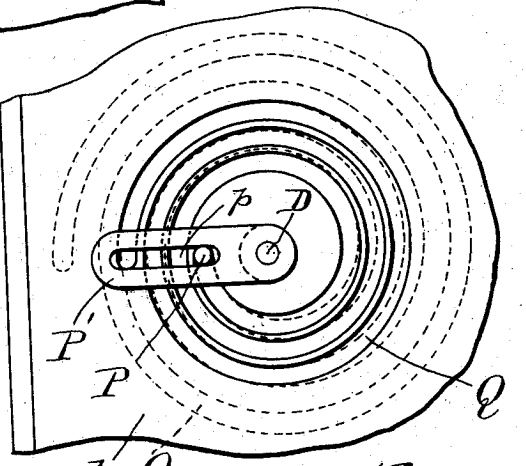


Fig. 11.

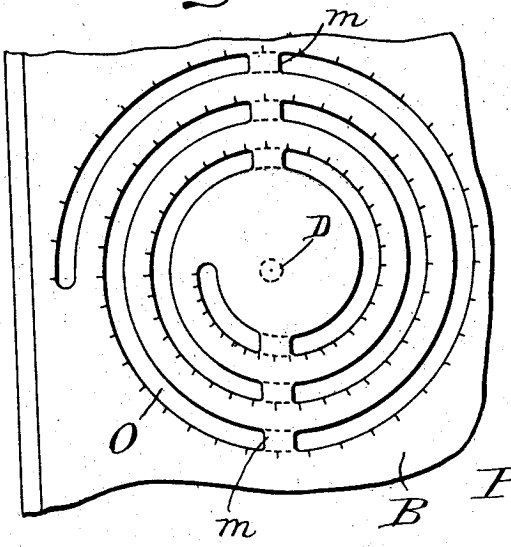
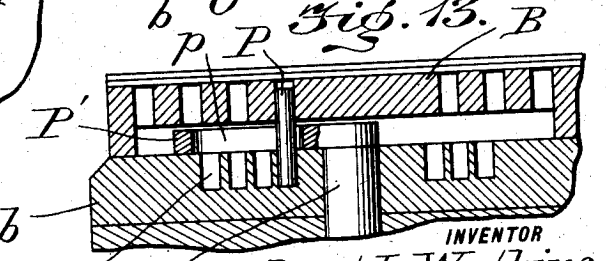


Fig. 13.



WITNESSES

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UNITED STATES PATENT OFFICE.

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MECHANICAL STAGE FOR MICROSCOPES AND THE LIKE.

No. 893,957. Specification of Letters Patent. Patented July 21, 1908.

Application filed November 11, 1907. Serial No. 401,620.

To all whom it may concern:

Be it known that I, ROBERT L. WATKINS, a citizen of the United States, residing in the city of New York, borough of Manhattan, county of New York, and State of New York, have invented a certain new and useful Mechanical Stage for Microscopes and the Like, of which the following is a specification.

This invention appertains to microscopes and analogous instruments, and more particularly to a mechanical stage for such instruments.

Some instruments of the prior art have been provided with a rack and pinion adjustment for moving the mechanical stage and the specimen under examination in one direction relative to the lens of the instrument, and an independent rack and pinion adjustment for shifting the stage and the specimen in a direction at right angles to the first adjustment. The employment of two sets of adjusting devices is objectionable for numerous practical reasons, chief among which are, first, the delay and annoyance incidental to the operation of the two devices, and, second, the increased cost of manufacture of the two rack and pinion devices.

The present invention is a single adjusting device so combined with a mechanical stage as to move it in any direction, both crosswise and lengthwise of such stage, preferably in an approximately rotary path or with a combined oscillatory and reciprocatory motion, whereby all parts of the field offered by the specimen may be brought into alinement with the axis of the lens, and the same spot of such field returned at any further time to the same position relative to the lens by noting a reading on a graduated scale.

In one practical form of construction, the invention comprises an operating stem or spindle, a member adapted to be rotated by said stem or spindle, and a mechanical stage coöperating with said member and adapted to be shifted by the movement of said member in a path other than a reciprocatory one.

Another practical form of the invention contemplates a slotted or grooved cam track provided in one of the parts, say the mechanical stage, a single stem or spindle, and a member operated by the other part, say the stem or spindle, and movable in said cam track for shifting the stage with an oscillatory and reciprocating motion. It is preferred to provide the cam track with a plurality of sections arranged one outside of the other and so connected as to produce a continuous channel, which may be in the form of a spiral, in which the spindle-operated member is adapted to travel. This construction enables the stage to be operated with a wide range of movement, so that a relatively large specimen may be brought into the field of the lens. Furthermore, the cam track is adapted to be calibrated for the purpose of readily determining a particular point in the field of the specimen, thus enabling the operator to readily adjust the specimen back to a particular point in case it is desired in the future to re-examine that part of the specimen.

The device of the present invention is especially useful in connection with microscopes employed by me to examine specimens of the blood, and for making enlarged photographs of such specimens; but it will be understood that the invention is not restricted to instruments for this particular work.

In order that others may understand the invention, I have illustrated different practical embodiments thereof in connection with one style of microscope which is shown in the accompanying drawings, but the constructions shown therein are to be understood as illustrative, only, and not as defining the limits of the invention.

Figure 1 is a side elevation of a microscope having my mechanical stage, and the adjusting device for said stage, applied to the fixed stage of the instrument. Fig. 2 is an enlarged plan view of the fixed stage, showing the mechanical stage partly broken away, in order to illustrate one form of the adjusting device for said mechanical stage. Fig. 3 is a vertical section through a portion of the fixed stage and the shiftable mechanical stage, illustrating one form of the adjusting device for said mechanical stage. Fig. 4 is an elevation, partly broken away and in section, showing another embodiment of the adjusting device for the mechanical stage. Fig. 5 is a horizontal section through a portion of the mechanical stage, on the line 5—5 of Fig. 4. Fig. 6 is a plan view of a portion of the mechanical stage, illustrating a calibrated cam track on an enlarged scale. Fig. 7 is a plan view, partly in section, of a mechanical stage provided with a preferred form of specimen holder. Fig. 8 is a cross section on the line 8—8 of Fig. 7. Fig. 9 is a plan of a mechanical stage showing another embodiment of means for retaining the stage in position.

Fig. 10 is a longitudinal section on the line 10—10 of Fig. 9. Fig. 11 is a plan view of a part of the mechanical stage having a spiral slot calibrated as contemplated by this invention. Fig. 12 is a plan view of another means for operating the stage shown in Fig. 11. Fig. 13 is a cross section through Fig. 12.

An ordinary microscope is indicated at A in Fig. 1 of the drawings. The instrument is shown as consisting of a base, *a*, a fixed stage or table, *b*, a column, *c*, a lens tube, *d*, adapted to be adjusted by a thumb screw, *d'*, and a mirror, *e*. These parts may be of the usual or any preferred construction, and it is not considered necessary to enter into a detailed description thereof.

B designates the mechanical stage of the instrument adapted to receive a specimen to be examined, said stage being shown as a plate resting loosely on the fixed table, *b*, for the purpose of bringing the specimen within the field of the lens. The particular form of the mechanical stage is not important, but as shown in Figs. 1 and 2, said stage is provided with suitable means, such as the clamps, C, adapted to retain the slide in contact with the upper side of the stage, B. The clamps, C, in the constructions of Figs. 1, 2, 3 and 4 are yieldable or spring fingers attached to short posts, *c'*, which are carried by arms, c^2, projecting from one edge of the stage, B.

The invention is not limited, however, to the spring fingers, C, for retaining a slide or specimen on the mechanical stage, B, for the reason that other means may be employed for retaining the slide or the specimen in place. Thus, in Figs. 7 and 8 of the drawings, the stage, B, is shown as having one yieldable clamp, M, near one end and a fixed clamp, M^2, at the other end. Said yieldable clamp is represented as a hollow strip or plate, confined in position on the stage, B, by screws, *m'*, and serving as an inclosure for the spring, M', the latter pressing the clamp, M, normally inward toward the other clamp, M^2, whereby the clamps are adapted for engagement with a slide which is placed on the stage, B, between said clamps.

One form of the adjusting device is shown in Figs. 2 and 3 of the drawings, wherein D designates an operating spindle which is mounted in a vertical position in an opening, *b'*, of the fixed table, *b*. The operating spindle is arranged near one end of said fixed table, and at its lower end said spindle is provided with a milled head, *f*, whereby the operator is able to easily reach the spindle and rotate it in the bearing, *b'*. The upper end of the spindle is provided with an eccentric or crank disk, E, which is shown as being countersunk in a recess, *e'*, provided in the upper face of the fixed table, *b*. The disk, E, is secured rigidly to the spindle, D, so as to turn therewith, and it lies below one end portion of the mechanical stage, B. Said disk is provided with a stud, pin or other projection, *g*, the same being eccentric to the operating stem, D. The stud, *g*, is adapted to fit into an opening or socket, *g'*, which is provided in the under face of the stage, B, whereby the stem and the shiftable stage, B, are connected operatively together.

The operating stem and the mechanical stage are connected at one end of the latter, but said shiftable stage is loosely held or confined on the fixed table, *b*, by any suitable contrivance, such as the rollers, studs or projections, F, F'. Said retaining devices are shown in Fig. 2 as consisting of rollers attached to the fixed table by suitable screws, said rollers being located near the opposite end of the mechanical stage, B, from the stem, D, and as being attached to the fixed table, *b*, near the respective side edges of the mechanical stage, B. The rollers, F, F', are placed relative to the stage, B, to permit the latter to move in an oscillatory path, as well as to reciprocate across the fixed table, *b*, when the eccentric stud, *g*, is rotated by the operating stem, D.

It is not desired to limit the invention to any special means for retaining the mechanical stage, B, in place on the fixed table, *b*. For example, I may dispense with the rollers, F, F', and provide a longitudinal slot, *k*, in the mechanical stage, B, said slot receiving a pin or stud, *k'*, (see Figs. 9 and 10), said stud being secured to the fixed table, *b*. This stud, *k'*, is disposed out of the way of the slide or the specimen to be held on the mechanical stage, B, and said stage, B, is movable or shiftable relative to the stud, *k'*, the latter serving, merely, to retain the shiftable stage in place on the fixed table, *b*. Should studs, F, F' be employed, they may be provided with shoulders, *f*, extending over the edges of the mechanical stage, (see Figs. 1 and 2), and the edges of the mechanical stage may be beveled, although said bevel is not essential.

The mechanical stage, B, is provided with suitable means for determining the position of a slide or specimen to be placed thereon, whereby different slides or specimens may be fitted to said stage in substantially the same position thereon. As shown, the clamps, M, M^2, on the stage, B, provide the parallel shoulders, *m*, near the respective ends of the stage, B, (see Figs. 7 and 8), between which shoulders the different slides or specimens are adapted to be placed, each occupying the same position relative to the stage, B.

A transparent slide, containing the specimen to be examined, is adapted to be placed on the mechanical stage, B, between the guide shoulders, *m*, and it is engaged by the clamps, C, or M, M^2. In one class of work, the specimen may be provided on a slide consisting of one or more glass plates containing

between them one or more drops of blood. After the slide or the specimen has been placed on the stage and engaged by the clamps, C, or M, M^2, the stem, D, is rotated for the purpose of turning the disk, E, and moving the eccentric stud, *g*, in a circular path, the axis of which is eccentric to the axis of said stem. When the stud or pin makes a quarter turn from the position of Fig. 2, the stage, B, and the specimen are moved in a direction transversely of the length of the stage; the next quarter turn of the eccentric stud, moves the stage and the specimen longitudinally; the next quarter turn moves the stage and the specimen crosswise and in an opposite direction to the first movement, whereas the final quarter turn of the eccentric stud moves the stage lengthwise and opposite to the second named (lengthwise) movement. It will thus be seen that the stud shifts the stage, B, in an oscillating path, as well as in a reciprocating path, and thus the stage is shifted with a comparatively wide range of movement, for bringing all portions of the specimen under view through the lens.

Figs. 4, 5 and 6 of the drawings show another practical embodiment of the invention wherein I employ means coöperating with the holder and the stem for the purpose of increasing the range of rotary or oscillating movement of the mechanical stage, B. As in the construction shown in Figs. 2 and 3, the fixed table, *b*, is adapted to support the mechanical stage, B, and said stage, B, is provided with suitable means for retaining the slide or specimen thereon. The fixed table, *b*, is provided with an opening, *b'*, for the reception of the operating stem, D, the latter having a milled head, *f*.

It is preferred to provide the stage, B, near one end thereof, with a cam track, G, and to attach to the operating stem a member, I, having a stud or projection, *i*, eccentric to the axis of the stem, as shown in full lines in Fig. 4 and in dotted lines in Fig. 5. But, if desired, the parts on the stage and the stem may be reversed, so that the cam track may be provided on the operating stem, D, and the eccentric member on the stage, B. The cam track is represented more clearly in Fig. 5, and in the enlarged detail view, Fig. 6. As shown, said cam track consists of slots, *j*, *k*, *l*, each struck from a center, said slots being eccentric to the axis of rotation at the points, *j'*, *k'*, whereby the slot, *l*, runs into the slot, *k*, and the slot, *k*, runs into the slot, *j*.

The sections, *j*, *k*, *l*, of the cam track may be grooves cut in the under face of the stage, B, but it is preferred to provide the slots, as shown in Figs. 4 and 6, in which case the rings formed by the slots are united by the webs, *m*, or by a cross bar attached to the stage, B, and to the several rings.

An advantage of the slotted construction is that the cam track may be calibrated substantially as shown in Fig. 6, thus enabling the operator to locate any particular point in the field afforded by the specimen.

The member, I, shown in Figs. 4 and 5, is an arm attached rigidly to an end portion of the stem, D, and the stud or projection, *i*, is attached to this arm, so as to serve the same purpose in the construction of Figs. 4 and 5 that the eccentric stud, *g*, serves in the construction of Figs. 2 and 3, to wit, as a means for imparting movement to the mechanical stage in a path other than a reciprocating one. In this connection it is to be noted that the stud, *i*, serves the additional purpose of a pointer or index which coöperates with the calibrations on the scale of the cam slot, shown in Fig. 6.

The operation of the device shown in Figs. 4, 5 and 6 is quite similar to that of Figs. 2 and 3. The rotation of the stem, D, operates the stud, *i*, to impart the desired oscillatory and reciprocatory movement to the mechanical stage, B, but when the stem, D, makes one complete turn, the eccentric stud, *i*, travels from one section of the cam track into the next section, through which second section the eccentric stud travels on the second rotation of the stem, so that it will then pass into the third section of the cam track, or said operations may be reversed by turning the stem, D, in the opposite direction.

As shown in Fig. 5, the eccentric stud is pointed so as to serve as an index relative to the scale of Fig. 6, enabling the operator to accurately and quickly determine a particular point in the field afforded by the specimen.

Instead of using a cam track, G, of the form shown in Figs. 5 and 6, it is preferred to employ a spiral shaped track, O, as shown in Figs. 11 and 12, said spiral track being generated on axes eccentric to the axis of rotation of the operating stem, D, the latter being mounted in the fixed table, *b*. In said Figs. 11, 12 and 13 there is represented one of the broad salient features of this invention. The mechanical stage, B, is not of large dimensions, and, necessarily, the calibrations on a cam track, such as G, are quite small owing to the number of turns in the track and the limited space for the reception of the indicating marks and characters. This renders the operation of reading the scale not easy, and requires close scrutiny. The construction of Figs. 11 to 13 is designed to remedy this objection, for the reason that the size of the spiral track, O, on the mechanical stage is enlarged quite materially in order that the indicating marks and the numbers may be more easily read. The construction shown in said figures is novel, also, in that a traveler or eccentric pin, P, is employed which is shifted in a radial slot, *p*, of

an arm, P′, on the stem, D, by traveling in a fixed cam track or spiral groove, Q, provided in the table, *b*. Said spiral groove, Q, in the fixed table has convolutions of less radius than the corresponding convolutions of the cam track, O, in the shiftable mechanical stage, B.

When the stem, D, is turned in one direction, the arm or member, P′, is rotated and forces the stud or pin, P, to move in the convolutions of the fixed cam track, Q, and in the cam track, O, of the shiftable stage, B, said pin P, riding in the radial slot, *p*, of the arm, P′. The pin, P, is held by the slotted arm, P′, and the fixed cam track, Q, from movement with the stage, B, whereby said stage is shiftable in a path other than a rectilinear path and, substantially, with an oscillating or spiral motion. Owing to the fact that the radius of the cam track, O, in the shiftable stage, B, is greater than that of the fixed cam track, Q, in the stationary table, *b*, the motion given to the mechanical stage, B, is amplified so as to still further increase the range of field of the slide or specimen held on the stage.

It is to be understood that the stage, B, is held or confined on the table, *b*, by the studs, F, F′, of Fig. 2, or the pin and slot, *k*, *k*′, of Figs. 9 and 10, or equivalent devices, and, further, that the shiftable stage, B, is provided with suitable means for retaining the slide or specimen thereon, such as the clamps, C, of Figs. 2 and 4, or the clamps, M, M², of Figs. 7 and 8, or means equivalent thereof.

Furthermore, it should be understood that Figs. 11, 12 and 13 represent one embodiment of means whereby a scale of easily readable size is provided on the mechanical stage which is to be shifted by a single device in a path other than a reciprocating one. While said figures represent one practical form of this part of the invention, it is not desired to limit said invention to the special construction shown therein.

As hereinbefore stated, the microscope is adapted for use in obtaining photographic enlargements of blood specimens, an apparatus for which purpose forms the subject matter of a prior application filed by me, Serial No. 373,985. In Figs. 1 and 4 of the drawings, I have shown the table, *b*, as provided with a photographic shutter, J, but it will be understood that this feature forms no part of the present invention.

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

1. In an instrument of the class specified, a mechanical stage, and means for imparting to said stage an oscillating and reciprocating movement.

2. In an instrument of the class specified, a mechanical stage, and a single operating device coöperating directly with the stage for imparting both crosswise and lengthwise movement thereto.

3. In an instrument of the class specified, a mechanical stage having means for confining a slide or specimen thereon, a table, and an operating device mounted on the table and coöperating with said stage for imparting an oscillating and reciprocating motion thereto.

4. In an instrument of the class specified, a table, a lens, a mechanical stage having means for confining a slide or specimen thereon, a single stem mounted on the table, and a member movable with the stem and coöperating with the stage for imparting thereto an oscillating and reciprocating motion.

5. In an instrument of the class specified, a table, a mechanical stage, means on said table for confining the stage so as to permit it to have an oscillating and reciprocating motion, and a single operating device for imparting such motion to said mechanical stage.

6. In an instrument of the class specified, a table, a mechanical stage, means projecting from the table and coöperating with said stage for permitting the latter to move in oscillatory and reciprocatory paths, and a single operating device for imparting such movement to said stage.

7. In an instrument of the class specified, a table, a mechanical stage, an operating stem, and coöperating devices directly connecting the stem and the stage for operating said stage in a path other than a rectilinear one.

8. In an instrument of the class specified, a table, a mechanical stage, an operating stem, a cam track on said stage, and a member operated by the stem and coöperating with said cam track.

9. In an instrument of the class specified, a mechanical stage provided with a cam track, and an operating device having means adapted to travel in said cam track for moving said stage.

10. In an instrument of the class specified, a mechanical stage, an operating device, a cam track on one of said parts, and a member on the other part and adapted to travel in said cam track.

11. In an instrument of the class specified, a mechanical stage, an operating device, a cam track consisting of a plurality of connected sections, said track being provided on one of said parts, and an operating member on the other part, said member being adapted to travel in the cam track.

12. In an instrument of the class specified, a mechanical stage, an operating device, a cam track having its parts calibrated, said cam track being carried by one of said parts, and an operating member movable with the

other part and adapted to travel in the cam track.

13. In an instrument of the class specified, a shiftable mechanical stage, a single manually operated device, and means directly coöperating with said stage and directly cooperating with said device for moving the stage in a path other than a reciprocating one.

14. In an instrument of the class specified, a mechanical stage, means for retaining a specimen thereon, means for operating the stage, and a unitary indicating means for designating the various positions of said stage whereby a particular place in the field of the specimen may be located.

15. In an instrument of the class specified, a mechanical stage, retaining means therefor, means movable with the stage for holding a specimen thereon, means for operating the stage in a path other than a reciprocating one, and indicating means operated by a single member for designating the various positions of the stage, whereby a particular point in the field of the specimen may be located.

16. In an instrument of the class specified, a mechanical stage, operating means coöperating with the stage for moving it in a path other than a reciprocating one, and unitary indicating means for designating the various positions of said stage.

17. In an instrument of the class specified, a mechanical stage, a shiftable operating member, cam tracks in which said member is adapted to travel, one of said tracks being on the stage and the other track being fixed relative to the stage, and means for indicating the changes in position of the stage.

18. In an instrument of the class specified, a mechanical stage provided with a scale, a manually operated member, and means cooperating directly with said stage and the said member whereby the changes in position of the stage are indicated on the scale and the stage is moved in a path other than a reciprocating one.

19. In an instrument of the class specified, a mechanical stage provided with a substantially spiral scale, a manually operated device, and indicating means movable with said device and coöperating with the stage and the scale, whereby the stage is shifted in a path other than a reciprocating one and the changes in position are denoted on the scale.

20. In an instrument of the class specified, a mechanical stage, a manually operated device, a spiral cam track on one of the aforesaid parts, and means operating in said cam track for moving the stage in a path other than a reciprocating one.

21. In an instrument of the class specified, a mechanical stage, a manually operated member, coöperating cam tracks, one being on the stage and the other being stationary relative thereto, and a traveler in said tracks and operated by the aforesaid means for moving the stage in a path other than a reciprocating one.

22. In an instrument of the class specified, a mechanical stage, a manually operated member, coöperating cam tracks of different radii, one being on the stage and the other being stationary relative thereto, and a traveler in said tracks and operated by the aforesaid means for moving the stage in a path other than a reciprocating one.

23. In an instrument of the class specified, a mechanical stage, a manually operated member, coöperating cam tracks, one being on the stage and the other being stationary relative thereto, a traveler movable in said tracks, and a slotted member fixed to the manually operated member for imparting movement to the traveler.

24. In an instrument of the class specified, a table having a cam track, a mechanical stage having a cam track, a stem, an arm fixed to the stem and having a radial guide, and a traveler sliding in said guide and movable in the cam tracks of the table and the stage respectively.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ROBERT LINCOLN WATKINS.

Witnesses:

MARIE B. BERLER,

H. I. BERNHARD.