C. A. HIRTH.

MICROMETER GAGE.

APPLICATION FILED MAY 10, 1907.

1,049,860.

Patented Jan. 7, 1913.

2 SHEETS—SHEET 1.

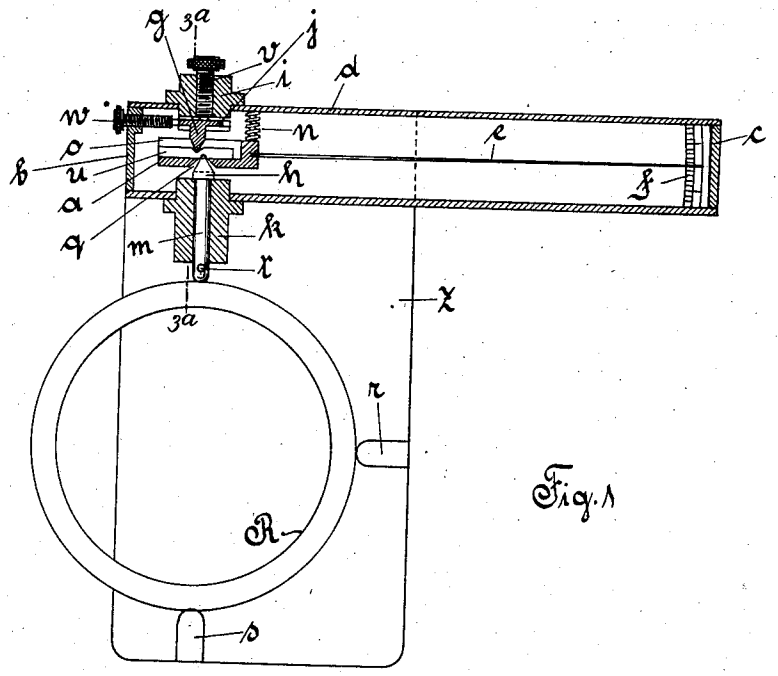

Fig. 1

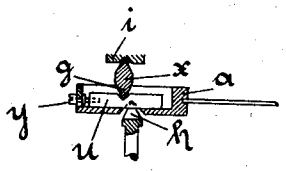

Fig. 2.

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2 SHEETS—SHEET 2.

Fig. 3.

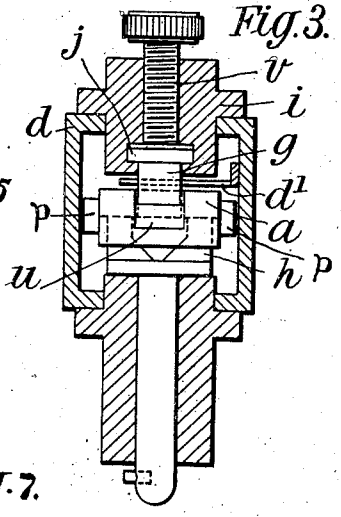


Fig. 6.

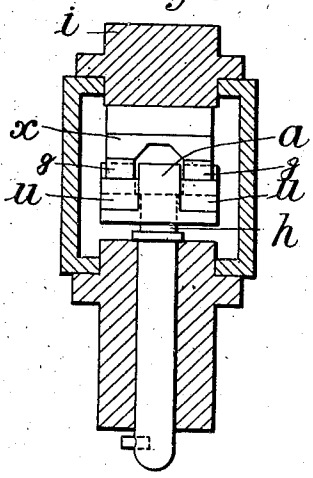


Fig. 4. Fig. 5

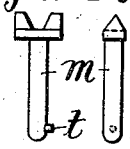


Fig. 7.

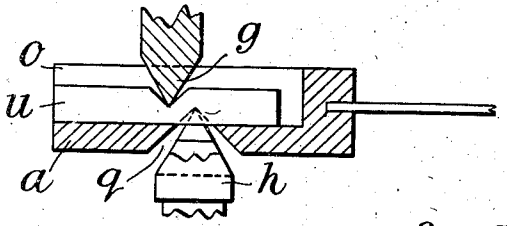


Fig. 8.

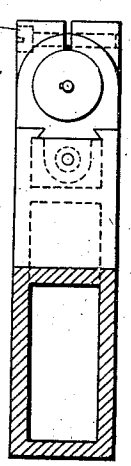


Fig. 9.

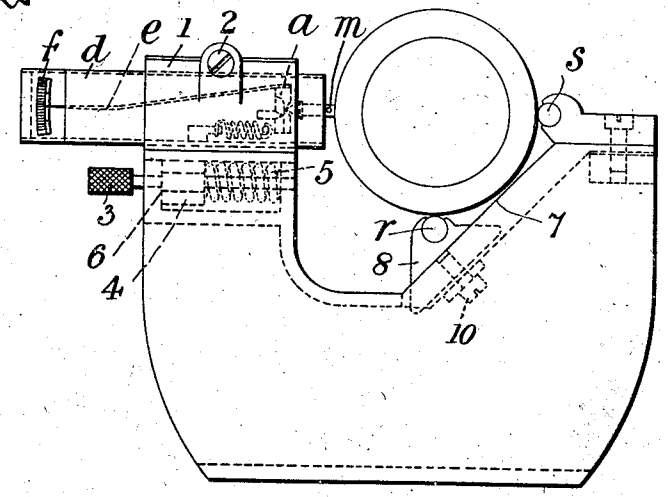
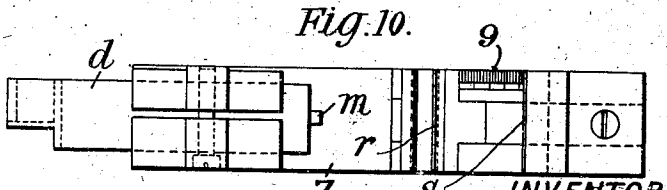


Fig. 10.



WITNESSES

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UNITED STATES PATENT OFFICE.

CARL ALBERT HIRTH, OF CANNSTADT, STUTTGART, GERMANY.

MICROMETER-GAGE.

1,049,860. Specification of Letters Patent. Patented Jan. 7, 1913.

Application filed May 10, 1907. Serial No. 372,947.

To all whom it may concern:

Be it known that I, CARL ALBERT HIRTH, a subject of the German Emperor, residing at Cannstadt, Stuttgart, in the German Empire, have invented a new and useful Improvement in Micrometer-Gages, of which the following is a specification.

The invention relates to improvements in micrometer gages and particularly to gages having a lever for indicating the measurements, the object being to provide an improved construction for the purpose of increasing the limit of accuracy.

With this object the device consists in its main features of a recessed lever having two arms of unequal length and loaded by a spring; the shorter arm of the lever is acted upon by one part of the object to be measured when another part of said object is applied to a fixed contact piece; and the longer arm of the lever takes the form of a pointer. This construction enables the ratio of amplification of the lever arms, *i. e.* the limit of accuracy to be carried to any desired extent without the necessity for using a double lever transmission. The lever is preferably mounted on knife edges both at its fixed point of rotation or fulcrum and at the movable point where pressure is applied; the said edges are relatively adjustable and fit on opposite sides into recesses in the lever and a short distance apart, the lever being pressed against the knife edges by a spring or any other convenient means.

In the accompanying drawings:—Figure 1 shows in longitudinal section one convenient form of gage according to this invention. Fig. 2 is a longitudinal section of part of a modified construction. Fig. 3 is a section taken on the line 3^a—3^a of Fig. 1. Figs. 4 and 5 are respectively front and side views of a detail. Fig. 6 is a section of the modified construction shown in Fig. 2. Fig. 7 is an enlarged view of part of the structure shown in Fig. 1, and Figs. 8, 9 and 10 illustrate a further modification in vertical section, elevation and plan respectively.

The indicating lever *a* is contained within a casing *d* provided with cover plates *b c*, and carries at one end a pointer *e* which is arranged to move over a scale *f* and is formed with two lugs *p* one on either side which act as lateral guides. A longitudinal recess or groove *o* is provided on one side of the lever *a* and a transverse recess or groove *q* is provided on the opposite side; the said recesses intersecting. In the longitudinal recess *o* is a slide *u* having a transverse groove in which a knife edged fulcrum *g* is located. The fulcrum *g* is mounted so as to be slidable in a supporting member *i* suitably secured to one wall of the casing. On the opposite side of the lever *a* a pin *m* is slidably mounted in a guide *k* suitably secured to the wall of the casing. The pin *m* has a head *h* formed with two knife edge portions with a space between them as shown in Fig. 4. These knife edges engage the transverse recess *q* on both sides of the slide *u*.

The lever *a* is supported between the knife edge of the fulcrum *g* and the knife edges of the pin *m*. A shoulder is formed between the head *h* and the pin *m* and a spring *n*, which is interposed between the casing and the fulcrum side of the lever, normally forces the pin *m* through its guide *k* until the shoulder abuts against this guide. It will be seen that when pressure is applied to the pin *m* the lever *a* will turn about its fulcrum *g* against the action of the spring *n* and the degree of displacement will be indicated by the pointer *e* on the scale *f*. The casing is mounted upon a base plate or support Z which carries fixed stops *r s* and the article to be measured or gaged (such for example the ring R) is made to contact with the two stops *r s* and the pin *m*. The size of the article can then be judged by comparing the deviation of the pointer with that produced by an article of standard dimensions.

The points where the knife edges make contact in their respective recesses lie on the same longitudinal plane of the lever and the relative distance between the two points is reduced to a minimum, that is to say, the two points almost coincide with each other so that the deflection of the lever may be increased to any convenient maximum extent without as hitherto necessitating double transmission by providing a second lever influencing the first.

Fig. 2 illustrates a modification of the gage, in which the lever *a* is mounted on knife edges both at the fulcrum and the point of application of pressure. This construction possesses the advantage in that the lever *a* turns uniformly on the knife

edge *g*. Since the obliquity of the lever *a* during its movement causes a relative displacement of the two points of action on the central line of axis of the lever, one of these two points must be rendered adjustable within narrow limits. In the modification illustrated in Fig. 1, this is accomplished by fitting the lever *a* with the movable strip *u*—which passes between the two knife edged portions of the head *h*—to form a movable abutment for the edge *g* and containing a recess for the latter extending to the central line or axis of the lever. The adjustable strip *u* is not secured to the part *a* so that a slight displacement of the said strip with relation to the lever *a* occurs automatically when the lever is moved into an inclined or slanting position in measuring, the edge *h* in that event moving in a straight line at right angles to the axis of the lever *a*. A further and positive adjustment may be attained as shown in either Fig. 1 or in Fig. 2. As shown in Fig. 1 the knife edge *g* is displaced in a slide *j* in the guide block *i*, by means of a micrometer screw *w*. The strip *u* is moved at the same time owing to its being engaged by the knife-edge *g*. This adjustment, however, is quite independent of the automatic adjustment of the strip *u* described above. The strip *u* enables the sensitiveness of the lever *a* to be adjusted by altering the relative distance between the knife edges. Since the strip *u* forms a firm abutment when the knife edges *g h* are within a fraction of a millimeter apart, the adjustment can be effected within wide limits. In the construction illustrated in Figs. 2 and 6, the regulation is effected by displacement of the strip *u* by a micrometer screw *y* arranged on the lever *a*, in which latter case the knife edge *g* must be mounted in its carrier or guide block *i* in such a manner as to allow it to oscillate, as shown in Fig. 2, in order to enable the two knife edges *g h* to undergo relative displacement during the swing of the lever *a*. To enable the pointer to be set to zero under varying adjustments of the gage, a micrometer screw *v* (Fig. 1) is provided above the slide *j* of the knife edge *g*, which screw *v* acts in opposition to the spring *n* so that the slide accurately follows the vertical movement of the micrometer screw *v*.

The further modified form illustrated in Figs. 8, 9 and 10, can be quickly and easily adjusted for measuring articles of different sizes. The pointer *e* of the lever is here mounted at right angles with the actual lever *a*, and the casing *d* of the gage lever is made cylindrical. The casing can be adjusted by hand in the bore of a holder *l* until the stop or pin *m* comes in contact with the article to be measured. The casing is then fixed in position by means of the clamping screw 2. The accurate adjustment of the gage lever to the zero point is effected by means of the micrometer screw 3, which acts on a female threaded attachment 4 of the holder *l*. The attachment 4 and micrometer screw 3 are forced toward the left by a spring 5, so that the shoulder 6 of the micrometer screw always rests against the wall of the frame.

The third stop *r* is adjustable for various dimensions of the article to be measured. For rings it is preferred to have the stop *r* movable on a plane 7 sloping toward the stop *s*, this arrangement enabling the rings to be always supported in the center, whatever their diameter. The stop *r* is mounted on a slide 8 which can be set by a scale 9, and fastened in position by a clamping screw 10.

What I claim is:—

1. In a micrometer gage the combination of support, a lever having a plurality of arms of unequal length one of said arms forming a pointer, a fulcrum mounted on said support and having a knife-edge contact with said lever a pin movably mounted in said support and having a knife-edge contact with said lever, one of said knife edges being forked and making contact with the lever on each side of the other knife edge whereby the points of contact may almost coincide, said pin being adapted to impart motion to said lever and means cooperating with the fulcrum and actuating pin whereby the pointer is normally held in a predetermined position.

2. In a micrometer gage the combination of a support, a lever having a plurality of arms of unequal length one of said arms forming a pointer, a fulcrum mounted on said support and having a knife-edge contact with one side of said lever, a pin movably mounted in said support and having a knife-edge contact with the opposite side of said lever, one of said knife edges being forked and making contact with the lever on each side of the other knife edge whereby the points of contact may almost coincide, said pin being adapted to impart motion to said lever and means coöperating with the fulcrum and actuating pin whereby the pointer is normally held in a predetermined position.

3. In a micrometer gage the combination of a support, a lever provided on its opposite sides with recesses, an adjustable knife-edge fulcrum entering a recess on one side of the lever, an actuating pin having a knife edge entering a recess on the opposite side of the lever and adapted to impart motion to the lever, one of said knife edges being forked and making contact with its recess on each side of the other knife edge whereby the point of contact may almost coincide, a pointer forming part of said lever, and

means coöperating with the fulcrum and actuating pin whereby the pointer is normally held in a predetermined position.

4. In a micrometer gage the combination of a support, a lever having a plurality of arms of unequal length one of said arms forming a pointer, and having a recess therein, a knife-edge fulcrum for said lever located in the said recess and mounted upon the support, a pin having a knife edge at one end and being movably mounted upon the support for applying pressure to one side of said lever being adapted at the other end to contact with the article to be measured, one of said knife edges being forked and making contact with its recess on each side of the other knife edge whereby the points of contact may almost coincide, means coöperating with the fulcrum and the actuating pin whereby the lever is supported in its normal position, means for adjusting the relative positions of the pin and the portion of the fulcrum about which the lever rocks, and stops carried by the support and against which the articles to be measured contact; substantially as described.

5. In a micrometer gage the combination of a support, a lever having a plurality of arms of unequal length one of said arms forming a pointer and said lever being provided with a plurality of recesses, a knife-edge fulcrum for the lever said fulcrum being located in one of said recesses and mounted upon the support, a pin having a knife edge at one end and movably mounted upon the support and being adapted to apply pressure to said lever said pin being adapted at the other end to contact with the articles to be measured and being in engagement with another of said recesses, and one of said knife edges being forked and making contact with its recess on each side of the other knife edge whereby the points of contact may almost coincide, means coöperating with the fulcrum and the actuating pin whereby the lever is supported in its normal position, and stops carried by the support and against which the articles to be measured contact; substantially as described.

6. In a micrometer gage the combination of a support, a lever having a plurality of arms of unequal length one of said arms forming a pointer and said lever being provided with a plurality of recesses, a knife-edge fulcrum for the lever said fulcrum being located in one of said recesses and mounted on the support, a pin having a knife edge at one end for applying pressure to said lever and being adapted at the other end to contact with the article to be measured, said pin being also in engagement with another of the said recesses and movably mounted on the support, and one of said knife edges being forked and making contact with its recess on each side of the other knife edge whereby the points of contact may almost coincide, means coöperating with the fulcrum and the actuating pin whereby the lever is supported in its normal position, means for adjusting the relative positions of the pin and the portion of the fulcrum about which the lever rocks, and stops mounted upon the support and against which the articles to be measured contact; substantially as described.

7. In a micrometer gage the combination of a support, a lever having a plurality of arms of unequal length one of said arms forming a pointer and said lever being provided on its opposite sides with recesses, a knife-edge fulcrum bearing against one side of the lever said fulcrum being located in one of said recesses and mounted upon the support, a pin having a knife edge at one end and being movably mounted upon the support and adapted at the other end to contact with the article to be measured and being also adapted to apply pressure to the opposite side of said lever said pin being in engagement with another of the recesses in the lever, and one of said knife edges being forked and making contact with its recess at each side of the other knife edge whereby the points of contact may almost coincide, means coöperating with the fulcrum and the actuating pin whereby the lever is supported in its normal position, and stops mounted upon the support and against which the articles to be measured contact; substantially as described.

8. In a micrometer gage the combination of a support, a lever having a plurality of arms of unequal length one of said arms forming a pointer and said lever being provided on its opposite sides with recesses, a knife-edge fulcrum bearing against one side of the lever said fulcrum being located in one of said recesses and mounted upon the support, a pin having a forked knife edge at one end for applying pressure to the opposite side of said lever said pin being adapted at its other end to contact with the article to be measured and being movably mounted upon the support and in engagement with two parts of another recess and at both sides of the other knife edge, means coöperating with the fulcrum and the actuating pin whereby the lever is supported in its normal position, means for adjusting the relative positions of the pin and the portion of the fulcrum about which the lever rocks, and stops mounted upon the support and against which the articles to be measured contact; substantially as described.

9. In a micrometer gage the combination of a support, a recessed lever having a plurality of arms of unequal length one of said arms forming a pointer, a fulcrum for said lever located in said recess and mounted upon the support, a pin mounted upon the

support and for applying pressure to one side of said lever, a strip longitudinally slidable in a recess in the lever and against which the fulcrum bears, means for moving the said strip, means coöperating with the fulcrum and the actuating pin whereby the lever is supported in its normal position, and stops mounted upon the support and against which the articles to be measured contact.

10. In a micrometer gage the combination of a support; a recessed lever having a plurality of arms of unequal length one of said arms forming a pointer; knife edges carried by the support and forming a fulcrum and supporting pin respectively for said lever, the knife edge of the said supporting pin being in two parts; a strip longitudinally slidable on said lever between the two parts of the knife edges of the said supporting pin whereby the position of the fulcrum may be adjusted; means for moving said strip; means coöperating with the fulcrum and the actuating pin whereby the lever is supported in its normal position; and stops mounted upon the support and against which the articles to be measured contact.

11. In a micrometer gage the combination of a support; a lever having a plurality of arms of unequal length one of said arms forming a pointer and said lever being provided with a plurality of recesses; a knife-edged fulcrum for the lever, said fulcrum being mounted upon the support and located in one of said recesses; a knife-edged supporting pin mounted upon the support and for applying pressure to said lever, the knife-edge of the said pin being in two parts that engage with one of the said recesses; a strip longitudinally slidable on said lever between the two parts of the said knife-edge whereby the position of the fulcrum may be adjusted; means for moving said strip; means coöperating with the fulcrum and the supporting pin whereby the lever is supported in its normal position; and stops mounted upon the support and against which the articles to be measured contact.

12. In a micrometer gage the combination of a support; a lever having a plurality of arms of unequal length one of said arms forming a pointer and said lever being provided on its opposite sides with recesses; a knife-edged fulcrum bearing against one side of the lever said fulcrum being mounted upon the support and located in one of said recesses; a knife-edged supporting pin mounted upon the support and for applying pressure to the opposite side of said lever, the knife edge of the said pin being in two parts that engage with one of said recesses; a strip longitudinally slidable on said lever between the two parts of the said knife edge whereby the position of the fulcrum may be adjusted; means for moving said strip; means coöperating with the fulcrum and the supporting pin whereby the lever is supported in its normal position; and stops mounted upon the support and against which the articles to be measured contact.

13. In a micrometer gage the combination of a support; a lever having a plurality of arms of unequal length one of said arms forming a pointer and said lever being provided on one side with a longitudinal recess and on the opposite side with a transverse recess; a knife-edged fulcrum bearing against one side of the lever said fulcrum being mounted upon the support and located in the longitudinal recess; a knife-edged supporting pin mounted upon the support and adapted to apply pressure to the opposite side of said lever, the knife edge of the said pin being in two parts that engage with the transverse recess; a strip longitudinally slidable on said lever in the longitudinal recess and between the two parts of the knife edge of the said supporting pin whereby the position of the fulcrum may be adjusted; means for moving said strip; means coöperating with the fulcrum and the supporting pin whereby the lever is supported in its normal position; and stops mounted upon the support and against which the articles to be measured contact.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

CARL ALBERT HIRTH.

Witnesses:
ERNEST ENTENMANN,
HNY. H. MORGAN.