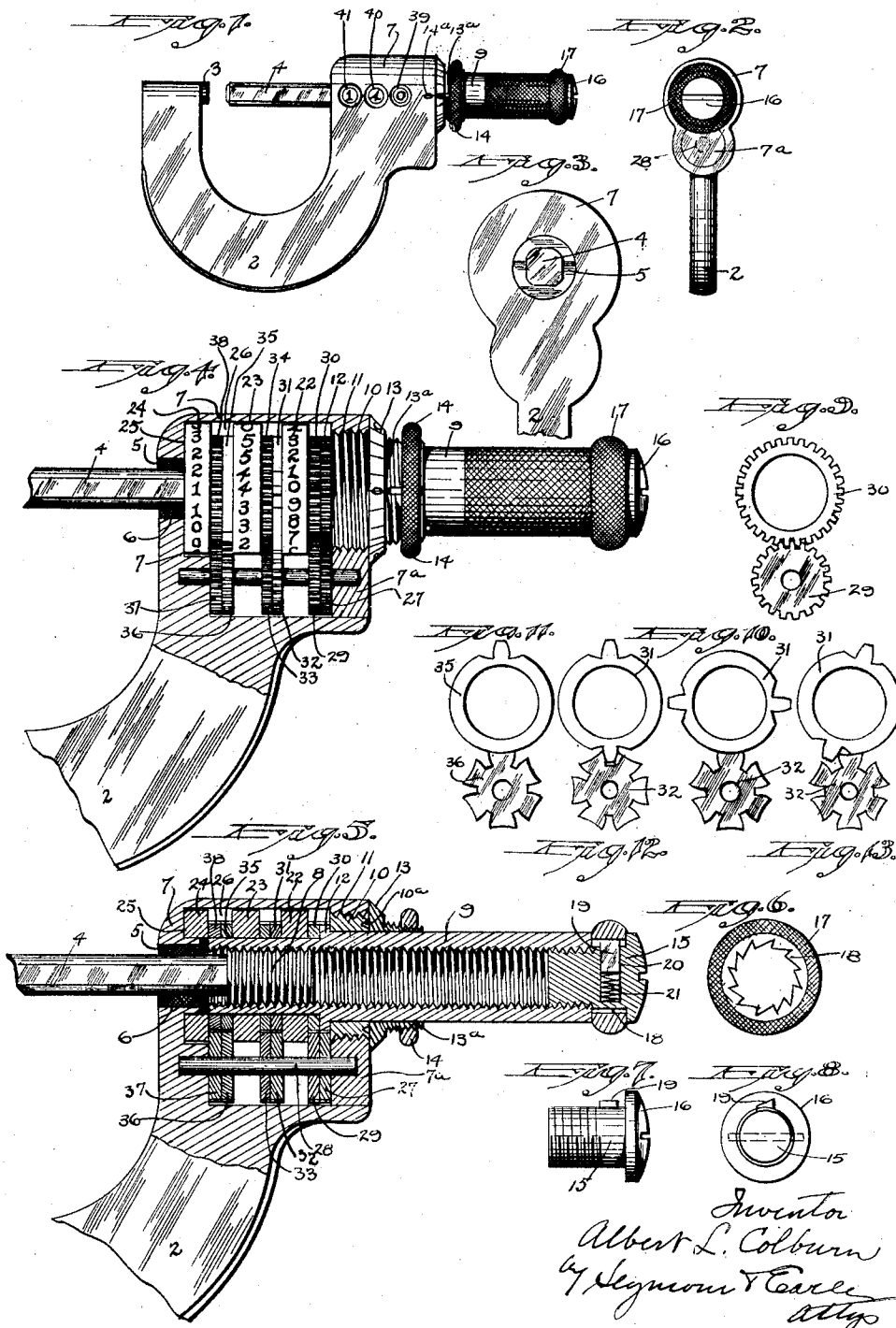


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DIRECT READING MICROMETER CALIPER.
APPLICATION FILED MAR. 4, 1920.

1,389,028.

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UNITED STATES PATENT OFFICE.

ALBERT L. COLBURN, OF NEW HAVEN, CONNECTICUT.

DIRECT-READING MICROMETER-CALIPER.

1,389,028.

Specification of Letters Patent. Patented Aug. 30, 1921.

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To all whom it may concern:

Be it known that I, ALBERT L. COLBURN, a citizen of the United States, residing at New Haven, in the county of New Haven and State of Connecticut, have invented a new and useful Improvement in Direct-Reading Micrometer-Calipers; and I do hereby declare the following, when taken in connection with the accompanying drawings and the characters of reference marked thereon, to be a full, clear, and exact description of the same, and which said drawings constitute part of this application, and represent, in—

15 Figure 1, a view in side elevation of a direct-reading micrometer caliper constructed in accordance with my invention;

Fig. 2, a view of the outer end thereof;

20 Fig. 3, an enlarged broken view thereof looking toward the end of the spindle;

Fig. 4, an enlarged broken view thereof partly in elevation and partly in central longitudinal section, showing the figure-wheels and the gears for driving the same;

25 Fig. 5, an enlarged broken view thereof in central longitudinal section;

Fig. 6, a detached plan view of the internal ratchet feed wheel;

30 Fig. 7, a detached view in side elevation of the coupling-screw;

Fig. 8, a reverse plan view thereof;

Fig. 9, a detached view showing the gear-wheel 30 and the pinion 29 of the device;

35 Fig. 10, a corresponding view showing the intermittent-gears employed for operating the tens figure-wheel;

Fig. 11, a corresponding view of the intermittent-gears employed for operating the hundreds figure-wheel;

40 Fig. 12, a detached view showing the intermittent-gears for operating the tens figure-wheel when in their central position;

Fig. 13, a similar view showing the same wheels after their movement one thousandth of an inch from the central position illustrated by the preceding figure.

My invention relates to an improved micrometer caliper of the direct-reading type, the object being to produce a simple, convenient, and reliable direct-reading instrument constructed with particular reference to preserving in a direct-reading caliper the familiar system of graduation used in ordinary calipers, to its adaptation to be operated by one hand, its ratchet-stop included, to the full limit of its measuring ca-

capacity, to positiveness and accuracy of operation, and to ease of adjustment to compensate for wear.

With these ends in view, my invention consists in a direct-reading micrometer caliper having certain details of construction and combination of parts as will be herein-after described and pointed out in the claims.

In carrying out my invention, I employ a bowed frame 2 mounting at its inner end an anvil 3 coöperating with a normally non-rotatable spindle 4 having bearing and longitudinal movement in a flanged bushing 5 located in a bearing-hole 6 in a housing 7 formed integral with the outer end of the bowed frame 2 aforesaid, the said bushing being forced into the said hole but not tight enough to prevent its being turned with the spindle and by the same when it is desired to take up wear between the spindle and the anvil.

At its inner end, the non-rotatable spindle 4 is provided with a threaded head 8 of forty threads to the inch. The said head 8 works back and forth in a rotatable but non-reciprocal sleeve 9 internally threaded throughout its length. The outer end of the said sleeve projects beyond the housing 7 and forms the handle of the caliper. Wear between the anvil 3 and spindle 4 may be compensated for by turning the spindle by a wrench or other means, whereby the spindle is longitudinally moved with respect to the said sleeve by which it is operated. The said spindle is normally held against rotation by its cross-sectional form and the cross-sectional form of the opening provided for it in the flanged bushing 5, as shown in Fig. 3. The object of making the bushing rotatable is to permit the spindle to be turned for taking up wear as described.

The said sleeve 9 has bearing in an externally threaded nut 10 mounted in a concentric threaded hole 11 formed in the outer end of the housing 7. The face of the nut 10 is made flush with the face of the end of the housing and formed with holes 10^a for the application of a spanner wrench by means of which it is removed and replaced. The inner face of the said nut provides a bearing for the outer face of the main driving-gear 12 of the device, the said gear being formed, as shown, by cutting teeth in the periphery of an annular shoulder made integral with the sleeve 9, though if preferred, the gear may be made independently of the

sleeve and forced thereupon. In either case, the sleeve is held against longitudinal outward movement by the said nut, while it is held against inward endwise movement by the bearing of its inner end upon the flanged inner end of the bushing 5, as shown in Fig. 5, whereby the sleeve is held against endwise movement in either direction, though left free to rotate; whereas in the calipers of the prior art, the sleeve is mounted upon the spindle rather than journaled in the frame, and moves longitudinally, as well as rotates.

Upon the sleeve 9, I mount a graduated beveled collar or dial 13 positioned upon the sleeve so as to have bearing upon the outer face of the nut 10 and the outer end of the housing 7 at a point thereupon around the threaded hole 11 formed therein for the reception of the nut 10, the said dial being formed with an integral outwardly extending tapered split and externally threaded binding-collar 13^a mounting an internally threaded knurled binding-nut 14 by which the collar is firmly gripped upon the sleeve for rotation therewith.

The said dial 13 is encircled by graduations running from zero to twenty-five, as required by the employment of forty threads to the inch upon the head 8 of the spindle 4. The graduations upon the dial are read in conjunction with a zero mark 14^a upon the front face of the housing 7 of the frame 2, as clearly shown in Fig. 1. By loosening the nut 14, the dial may be adjusted in its position upon the sleeve 9 so as to compensate for wear and so as to keep its graduations in absolutely correct relation to the zero mark 14^a.

I may here state that standard calipers are generally constructed on the principle of forty pitch threads and twenty-five graduations, but I do not limit myself to this combination, as my device is perfectly well adapted to other pitch of threads and other systems of graduation.

At its outer end, the sleeve 9 mounts what is known in this art as a "ratchet-stop" mechanism for the reason that the caliper ceases to function as soon as such mechanism begins to function. My improved ratchet-stop comprises, as shown, a screw-plug 15 the overhanging head 16 of which holds an internal ratchet-feed wheel 17 against the outer end of the said sleeve, as shown in Fig. 5. The said wheel 17 has a rounded knurled periphery somewhat larger in diameter than the diameter of the sleeve; this is not necessary, though preferable. The internal ratchet-teeth 18 of the said ratchet-feed wheel 17 are engaged by the nose or beveled outer end of a reciprocating pawl 19 set into a hole 20 formed transversely in the outer portion of the screw-plug 15 and also receiving a helical spring 21 which exerts a constant effort to force the nose of the pawl

into engagement with the teeth 18. The said spring 21 is adapted in tension to hold the pawl 20 in engagement with the ratchet-teeth 18 during the normal operation of the device, and only yields to permit the retirement of the pawl when the force employed for the rotation of the sleeve is great enough to endanger the springing of the bowed frame 2 and so destroying the utmost accuracy of measurement.

For the direct reading of measurements made by the instrument, I employ three figure-wheels 22, 23, and 24 of which the wheels 22 and 23 turn loosely upon the inner end of the sleeve 9, while the wheel 24 turns within an annular recess 25 offsetting from the inner wall of the gear-chamber 26 of the housing or chambered head 7. The figure-wheels 22, 23, and 24 respectively indicate units of a thousandth, tens of thousandths, and hundreds of thousandths. For convenience of designation, the figure-wheel 22 will be called the "units" wheel, the figure-wheel 23, the "tens" wheel, and the figure-wheel 24, the "hundreds" wheel.

The figures on the figure-wheel 22 are arranged in two sets from 0 to 9 inclusive, each occupying a half of the periphery of the wheel. The figure-wheels 23 and 24 are characterized by having their figures arranged, as it may be said, in double sets running from 0 1 2 to 9 inclusive around the whole periphery, making twenty figures in all, on each wheel. The novel arrangement is one of the salient characteristics of my improved invention.

For driving these figure-wheels, the main driving-gear 12 aforesaid, is provided with twenty-one teeth and meshed into a pinion 27 having twelve teeth and mounted to turn loosely upon a shaft 28 located in the lower portion of the gear-chamber 26 and journaled at its rear end in the inner wall of the housing 7, and at its opposite end in a removable plug 7^a set into the housing. A pinion 29 of fifteen teeth is secured directly to the inner face of the pinion 27 by which it is revolved. The said pinion 29 meshes into a gear-wheel 30 of twenty-one teeth. The said gear 12, pinions 27 and 29, and gear 30, are employed to reduce the movement of the spindle and are made necessary by its provisions with a forty pitch thread.

The said gear-wheel 30 is secured directly to the outer face of the figure-wheel 22 which is revolved by it, and the inner face of which has secured to it an intermittent gear-wheel 31 of two teeth, which meshes into a star-gear 32 of six double teeth turning loosely upon the shaft 28 aforesaid and having secured to its inner face a pinion 33 of nine teeth, which meshes into a gear-wheel 34 of fifteen teeth, secured to the outer face of the figure-wheel 23 upon the inner face

of which is secured an intermittent-gear 35 of one tooth meshing into a star-wheel 36 of six double teeth, as shown in Fig. 11. The star-wheel 36 is loosely mounted upon the shaft 28 aforesaid, and has fastened to it a pinion 37 of nine teeth, which meshes into a gear-wheel 38 of fifteen teeth, which is secured directly to the figure-wheel 24 which is rotated by it.

The numerals upon the several figure-wheels 22, 23, and 24 are exposed one at a time through three sight-holes 39, 40, and 41 formed in the face of the housing 7.

It will be seen, by reference to Figs. 10 and 11 that the intermittent gear-wheel 31 and its star-wheel 32 and the intermittent gear-wheel 35 and its star-wheel 36 constitute examples of what is known as the "Geneva" stop-movement, this type of gearing being self-locking and securing economy of space.

The intermittent gear-wheels 31 and 35 are calculated on a basis of twenty teeth to the full circumference, while the star-wheels 32 and 36 are calculated, as shown, on the basis of twelve teeth to the full circumference, though actually cut to provide six double teeth. However, the number of teeth in wheels 32 and 36 is, theoretically, immaterial so long as the number is even.

Inasmuch as the wheels 31 and 35 have in theory the same number of teeth in the full circumference as there are numerals on the respective figure-wheels 22, 23, and 24, the several numerals thereon represent thousandths of an inch in the movement of the spindle 4 with respect to the anvil 3. In the system of gearing described, the two oppositely located teeth of the gear-wheel 31 respectively respond to the double set of numerals running from "1" to "10" on the figure-wheel 22, while the double teeth of the star-wheels 32 and 36 respond to the novel complementary pairs of numerals having linear as well as serial arrangement upon the figure-wheels 23 and 24.

In the operation of my improved caliper, the turning of the sleeve through ten graduations on the graduated collar or dial 13 actuates the intermittent gear-wheel 31 in a half-rotation, whereby one of the two teeth of the wheel 31 co-acts with one of the double teeth of the star-wheel 32 so as to revolve the same from one of its locked positions to its next locked position, the movement of the wheel 32 from one locked position to another being equivalent to a movement of the spindle two thousandths of an inch, due to the fact that the teeth of the star-wheel are double teeth. This movement of the star-wheel 32 is transmitted by the pinion 33 and wheel 34 to the figure-wheel 23 which is rotated for a distance representing two thousandths of an inch. During the movement of the wheel 23 to the first

tenths of an inch, one figure of one of its complementary pairs of figures will be shown through the sight-hole 40. Thus, as shown in Fig. 1, the numeral "4" appears in the sight-hole 40. At the same time, the "0" of one of the two sets of figures on the wheel 22, appears through the sight-hole 39. At this time, the tooth of the wheel 31 in engagement with a tooth of the star-wheel 32, will be in line with a plane passing through the axes of these two wheels, as shown in Fig. 12. Now, as the wheel 32 is moved by the wheel 31 from the central position in which it is shown in Fig. 12, to the position in which it is shown in Fig. 13, the figure-wheel 23 is rotated for a distance representing one thousandth of an inch with the effect of bringing the other "4" of its complementary pair of numerals "4" into view through the sight-hole 40, while at the same time, the figure-wheel 22 has been correspondingly moved to bring the numeral "1" of its same series of figures, to view through the sight-hole 39. The operation of the figure-wheel 24 by the intermittent-gear 35 and the star-wheel 36 corresponds to the operation just described for the figure-wheel 23.

So far as the direct-reading feature of my improved caliper is concerned its salient characteristic is the employment of a tens wheel, and a hundreds wheel, having pairs of complementary figures arranged lineally.

It will thus be seen that I have combined the familiar micrometer caliper principle of twenty-five graduations and a forty pitch thread with the principle of direct-reading, whereas in most of the direct-reading micrometers of the prior art, the spindle has been operated on the basis of fifty threads to the inch with twenty graduations. I prefer to employ the more familiar principle of forty threads to the inch, though I am not precluded from constructing my gear system to operate in conjunction with a spindle having fifty threads to the inch.

Under my improved construction, the instrument may be operated by one hand, including its ratchet-stop, to the full limit of its measuring capacity, which is a matter of greatest convenience. I wish also to point out that under my construction, as the spindle does not rotate, there is no danger of moving it in its manipulation so as to change the set and destroy the measurement.

I claim:

1. A micrometer caliper having a frame, an anvil, an externally threaded spindle mounted in the said frame so as to be normally non-rotatable, but adapted to be turned by unusual force for taking up wear between it and the anvil, and a rotary sleeve held against endwise movement and provided substantially throughout its length

with internal threads with which the threads of the spindle directly co-act.

2. A micrometer caliper having a frame, an anvil, a normally non-rotatable spindle having external threads, a rotary sleeve held against endwise movement and provided substantially throughout its length with internal threads with which the threads of the spindle directly co-act, and mounting means for the spindle normally holding the same against rotation but turnable by unusual force to permit the spindle to be turned to take up wear between the spindle and the anvil.

3. A micrometer caliper having a frame, an anvil, a bushing mounted in the said frame, a spindle sliding in the said bushing by which it is normally held against rotation and provided with external threads, and a rotary sleeve held against endwise movement and provided substantially through-out its length with internal threads with which the threads of the spindle directly co-act, the said bushing normally holding the spindle against rotation but yieldingly rotatable to permit the spindle to be turned to take up wear between it and the anvil.

4. A micrometer caliper having a frame, an anvil, a normally non-rotatable spindle provided at its inner end with an external head of larger diameter than the body of the spindle, a rotary sleeve held against endwise movement and provided substantially through-out its length with internal threads which directly co-act with the threaded head of the spindle, and mounting means for the spindle adapted to permit the same to be turned to compensate for wear between it and the anvil.

5. A micrometer caliper having a frame, a normally non-rotatable spindle provided with external threads, a rotary sleeve provided substantially through-out its length with internal threads directly co-acting with the threads of the spindle, an annular bearing located upon the sleeve, a nut mounted in the frame and co-acting with the said bearing for preventing the endwise outward movement of the sleeve, and means for holding the sleeve against inward endwise movement.

6. A micrometer caliper having a frame, a normally non-rotatable spindle having external threads, a rotary sleeve internally threaded substantially through-out its length for direct engagement with the threads of the spindle, a main driving gear located upon the sleeve, a nut mounted in the frame and co-acting with the outside of the said gear for holding the sleeve against outward movement, and means for holding the sleeve against endwise inward movement.

7. A micrometer caliper having a frame, an anvil, a normally non-rotatable spindle

provided with external threads, a normally non-rotatable bushing mounted in the frame and providing a bearing for the spindle which it normally holds against rotation and by which it is turned when the spindle is turned to compensate for wear between it and the anvil, a rotary sleeve internally threaded for direct co-action with the threads of the spindle and bearing at its inner end against the said bushing, whereby it is held against endwise inward movement, and means for holding the sleeve against outward movement with respect to the frame.

8. A micrometer caliper having a frame, a non-rotary threaded spindle, a bushing mounted in the frame and receiving the said spindle which is held against rotation by it, a rotary sleeve internally threaded for direct co-action with the spindle and journaled for rotation in the frame in which it is held against endwise inward movement by the engagement of its inner end with the said bushing, a bearing upon the sleeve, a nut mounted in the frame and co-acting with the said bearing for holding the sleeve against endwise outward movement, a graduated dial adjustably mounted upon the sleeve on which it is positioned close to the said frame.

9. In a micrometer caliper, the combination with a frame, of a flanged bushing frictionally mounted therein, a spindle passing through the said bushing by which it is held against rotation and having its inner end provided with threads, and a rotary sleeve journaled in the frame and internally threaded for direct co-action with the threads of the spindle which is adjusted for wear by the bodily rotation of the bushing in the frame.

10. A micrometer caliper having a frame, a normally non-rotatable externally threaded spindle, a sleeve internally threaded substantially throughout its length for direct co-action with the said spindle, and a graduated collar adjustably mounted upon the sleeve for rotation therewith.

11. A micrometer caliper having a frame, a normally non-rotatable spindle having an externally threaded head, a sleeve held against endwise movement and provided substantially throughout its length with internal threads for directly co-acting with the threads of the said head of the spindle, a graduated collar or dial formed with a split hub by means of which latter it is adjustably mounted directly upon the said sleeve, and ring-nut mounted upon the said hub for gripping the sections thereof upon the sleeve.

12. A direct-reading micrometer caliper having a chambered frame, a normally non-rotatable spindle having external threads, a rotary sleeve held against endwise move-

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ment and provided substantially throughout its length with internal threads for direct co-action with the threads of the spindle, a wheel upon the said sleeve, and direct-reading gear mechanism located within the said frame and driven directly by the said wheel. 5

13. A direct-reading micrometer caliper having a frame, a spindle, a sleeve for operating the same, and direct-reading mechanism including a units figure-wheel, a tens figure-wheel, a hundreds figure-wheel, a "Geneva" stop-movement co-acting with the said units wheel for operating the said tens wheel, a "Geneva" stop-movement co-acting 10

with the said tens wheel for operating the said hundreds wheel, and gearing connecting the said sleeve with the said units wheel for the operation of the same, the figures of the tens figure-wheel and of the hundreds figure-wheel being arranged in pairs lineally and serially. 15 20

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

ALBERT L. COLBURN,

Witnesses:

GEO. D. SEYMOUR,
J. HAROLD FLYNN,