Nov. 9, 1926. 1,605,922

G. M. COOK

SLIDE RULE

Original Filed Dec. 28, 1922

Fig. 1.

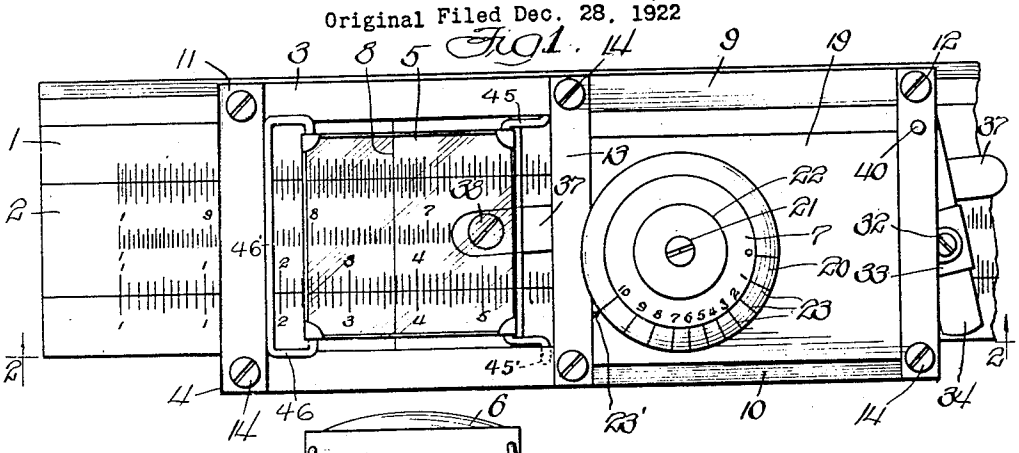


Fig. 2.

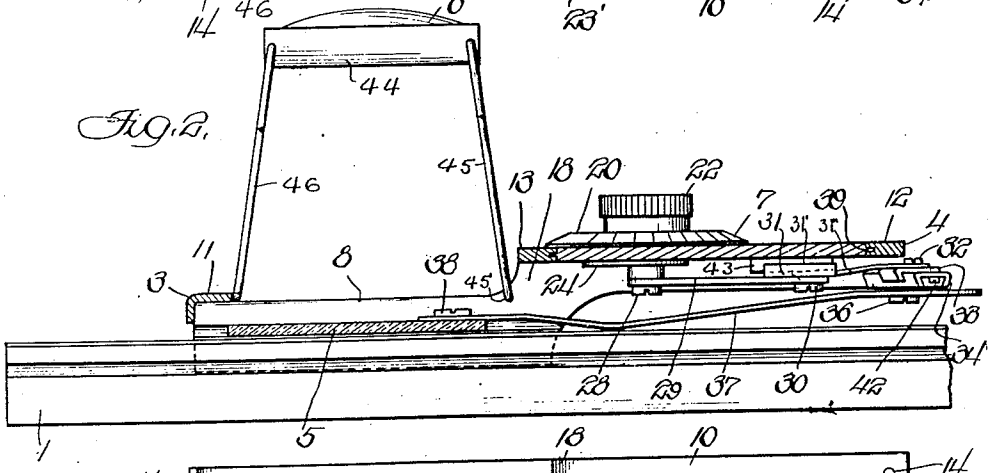


Fig. 3.

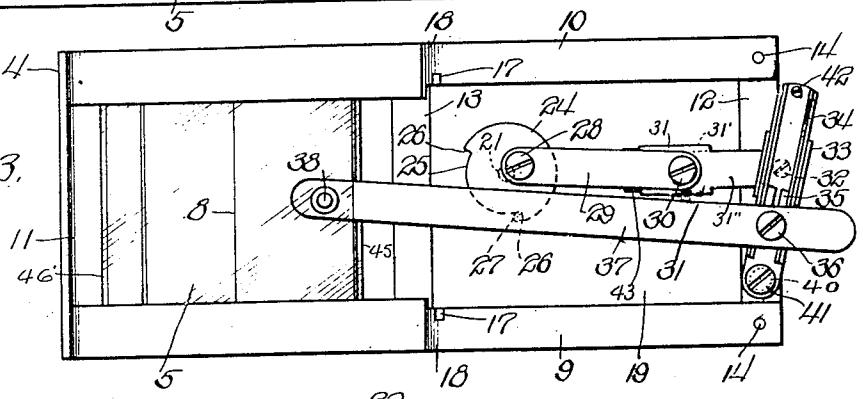


Fig. 4.

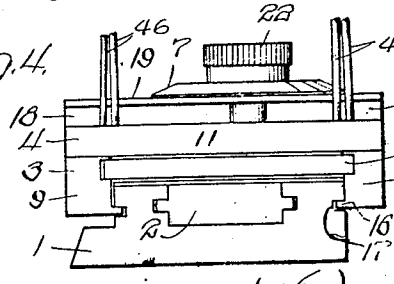
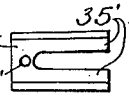


Fig. 5.



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UNITED STATES PATENT OFFICE.

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SLIDE RULE.

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This invention relates to slide-rules and more especially to improved means for accurate setting and reading of such instruments. The ordinary rule of this sort has two or more sets of lineal graduations, some of which are on a sliding piece, so that some function of a number on one piece is formed opposite it on the other. Generally both scales are graduated to the logarithms of the numbers on them, so that products may be read direct. A hair-line runner is usually supplied to facilitate setting and reading the device accurately. The successive gage units are not uniform, but vary according to certain laws well known in the art. This characteristic augments the difficulty in obtaining accurate results. Heretofore, so far as I am aware, the runner settings have been obtained merely by direct manual operation, guided either by direct visual observation of the hairline and gage marks, or at most by the aid of a magnifying attachment limited to lengthwise enlargement of the scale.

The main objects of this invention are to provide for amplifying the practical utility range of slide-rules by rendering them more precise and convenient to operate; to provide positive mechanical means for setting of the runner according to fractions of a scale unit; to equip such a device with micrometric means adapted for securing great refinement and accuracy in this setting; to provide readily adjustable means adapted to vary the range of this supplementary apparatus so as to divide scale units of various lengths, whereby the application of the device may be extended to cover all ordinary uses of the slide-rule; to provide an improved form of magnifying means; and to provide an improved and more convenient form of mounting or support for the magnifying lens, adapted for folding compactly and for ready manual shifting and adjustment.

An illustrative embodiment of this invention is shown by the accompanying drawings, in which;

Figure 1 is a plan of the left end of an ordinary slide-rule with the runner thereon. and showing the micrometric attachment on the right side of the runner. This elevation is shown as looking through magnifying lens, but to prevent misleading distortion in drawing, no magnification is shown.

Fig. 2 is mainly a longitudinal section substantially on the line 2—2 of Figure 1, the front edge of the rule being shown in elevation.

Fig. 3 is an underside view of the runner and its micrometric attachment.

Fig. 4 is a left end view of the rule with the runner in place, the lens and upper ends of the supports therefor being broken away.

Fig. 5 is an enlarged underside plan of the lever shoe for the hair-line link.

The construction of the fixed member and slide of the rule shown in the said drawings is the same as usually found in slide-rules of this general character, the novelty of construction and operation being in the runner and its attachments. The device as a whole, comprises a fixed member 1, a slide 2, and the runner 3. Said runner in turn comprises an oblong frame 4 of special extended overhanging form, in combination with a hair-line plate 5 mounted slidably thereon, an adjustably mounted lens 6, and a micrometer-like device 7 having adjustable connections extending to the plate 5 for setting the hair-line 8 on the rule gage to indicate precisely the fractional space desired.

The runner frame 4 comprises a rear side bar 9, a front side bar 10, a left end cross bar 11, a right end cross bar 12, and a medial cross bar 13, said bars being fastened together rigidly by screws 14, as shown in Figure 1. The left halves, more or less, of the two side bars are formed at their lower edges with inwardly projecting flanges 16, such as are usually provided on slide-rule runners to engage the corresponding grooves 17 formed in the edges of the fixed member 1. The right end halves approximately of said side bars are offset upwardly as at the medial points 18 sufficiently to clear the member 1, and serve to support the micrometer attachment and its connections.

For the purpose of supporting the micrometer and certain associated parts, a platform plate 19 is mounted with its upper face flush between the cross bars 12 and 13, and is manually slidable forwardly and backwardly thereon as will be more fully explained. On the left part of this plate is pivotally mounted the arcuately calibrated disk 20 which is carried pivotally by the screw 21. Said disk 20 is provided with a

knurled head 22 adapted to facilitate turning by the thumb and finger, and is also provided with gage marks 23 which are variously spaced successively, as will be explained. A co-relative stationary mark or index pointer 23′ is provided on plate 19.

On the underside of said plate 19, and secured to said disk 20 coturnably, is a crank disk 24 which is provided with an arcuate notch 25 having an effective angular range of (preferably) one hundred and twenty degrees, the ends of which notch serve as shoulders 26 to engage a stop pin 27 set in the underside of said plate 19. Said crank disk 24 is also provided with a downwardly projecting crank pin in the form of a screw 28 from which a link 29 extends toward the right. Said link 29 is secured by a pivot screw 30 to a longitudinally movable slide member 31 carried by platform 19, which member in turn is pivoted at its right end by means of screw 32 to a channel-like transversely disposed guide 33 for the horizontally swinging transversely disposed lever 34. Said lever is also of channel shape and contains a longitudinally movable slide shoe 35 to which is pivotally connected, as by screw 36, a link 37 which leads to the left and is pivoted by screw 38 to the hair-line plate 5. Said shoe 35 is yoke-shaped and its two arms 35′ press outwardly by spring action against the side flanges of lever 34. The screw 36 fits in the hole 35″ of said shoe.

The platform 19 is slidable manually by reason of the tongue and groove construction shown at 39 on Figure 2. The movement of plate 19 is forwardly limited by the disk 24 contacting with bar 9, and rearwardly by shoe 33 contacting endwise against the stud 40 which carries the pivot screw 41 on which lever 34 swings. The rearward swing of lever 37 is limited by the shoe 35 contacting against the head of pivot screw 41, and its forward swing is arrested by the stop screw 42 on lever 34.

The slide member 31 comprises a left end body part having upwardly turned side flanges 31′ and a right end extension 31″ carrying the pivot 32. Said flanges 31′ embrace the longitudinally disposed guide block 43 fixed on the underside of platform 19. Hence, the to-and-fro movements of slide 31 and pivot 32 are rectilinear.

The lens 6 is set in a frame 44 having a pair of foldably arranged supports 45 and 46 pivotally connected to the right and left edges, respectively.

The right support 45 is U-shaped with downwardly projecting sides having outwardly turned pivots 45′ to enter horizontal holes in the side bars 9 and 10. The left support 46 is free at its lower end and includes a crosswise part 46′ which rests on the runner frame. The supports 45 and 46 are inclined somewhat convergently toward the top. Hence the right side of the lens tilts downwardly slightly as it swings to the left and vice versa, though it stands horizontal in its normal position as shown by Figure 2.

Referring to Figure 1, it will be seen that turning the micrometer head 22 clockwise moves the hair-line plate 5 to the left, and vice versa, and the movement of plate 5 is nearly proportional to the angular movement of dial plate 20. In order to provide for this movement the crank pin 28 is positioned directly in front of pivot 21 on disk 24 when the latter is midway between the limits of its movement as determined by the shoulders 26. That is to say, the crank pin 28 swings in an arc so limited and disposed that its movement is not only nearly rectilinear but is substantially parallel with the direction of movement of the hair-line.

The oscillation range of plate 5 may be increased by pulling the free end of link 37 forward and vice versa, for when pivot 36 is near the free end of lever 34 it swings farthest and when near pivot 41 it swings least, but its approach to pivot 41 is limited as above explained. Said range may be further increased by pushing platform 5 back subject to the limitation above explained, and vice versa, for when the platform is pushed back the virtual actuating arm of said lever is shortened, and a given linear movement of pivot 30 augments the angular throw of said lever, the effective length of the arm which carries pivot 36 remaining unchanged. For practical purposes the units to be divided are relatively small; hence, the plate 19 is pulled forward and the lever 37 pushed back. For larger units the lever 37 is pulled forward accordingly. The micrometer scale shown on disk 20 represents a harmonic division of the logarithmic scale.

In use, if a fractional reading is to be taken the lever 37 and plate 19 are set so that when disk 20 is rotated through its range (120 degrees) the hair-line will traverse the unit distance concerned, the final adjustment being obtained by moving the plate 19. This is accomplished by setting the hair-line at the left edge of the given unit with the disk 20 set at zero. Then the disk 20 is swung to its opposite position and the plate 19 is adjusted to bring the hair-line exactly on the right edge of said unit. In doing this the link 37 may also be re-set if necessary. Then with the hair-line at the left edge of the unit space and the disk 20 at zero, said disk is turned counter-clockwise sufficiently to bring the hair-line on the fractional setting in question. The desired fraction in tenths of a unit may then be read on the disk 20.

In a similar manner, the hair-line may be set on any desired fraction of a unit as

follows:—First the plate 19 is adjusted to provide for unit movement of the hair-line for a full swing of disk 20. Then when the disk 20 is turned to the desired fraction, the hair-line will be set accordingly on the fractional space to be set off on the rule scale.

The micrometer scale is calibrated substantially as follows:—The link 37 and plate 19 are first adjusted relative to lever 34 so that a full swing of disk 20 will cause the hair-line to traverse some unit of the scale which is shown divided into ten parts (logarithmic). The disk 20 is then turned from its one extreme position to its other extreme position (120 degrees), and as the hair-line reaches successive division marks the plate 20 is marked accordingly.

All of the scale units to be measured by this micrometer are small,—not over a sixteenth of an inch. Hence, a limited throw of plate 5 and lever 34 is sufficient, and the platform 19 is, therefore, pulled forward so as to limit the movement of said lever to a small arc.

Although but one specific embodiment of this invention is herein shown and described, it is to be understood that numerous details of the construction shown may be altered or omitted without departing from the spirit of this invention as defined by the following claim.

I claim:

In a slide-rule runner, micrometric means and connections therefor, including a rotary index member, a lever pivoted to the runner frame, a member slidably connected to said lever in relatively turnable relation thereto, and a link connected at one end to an eccentric part of said index member and at its other end to the slide member whereby harmonic motion may be imparted thereto by uniform turning of said index member.

Signed at Chicago this 26th day of December 1921.

GEO. M. COOK.