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E. W. HEERICH  
CALCULATING DEVICE

2,532,619

Filed June 28, 1948

3 Sheets-Sheet 1

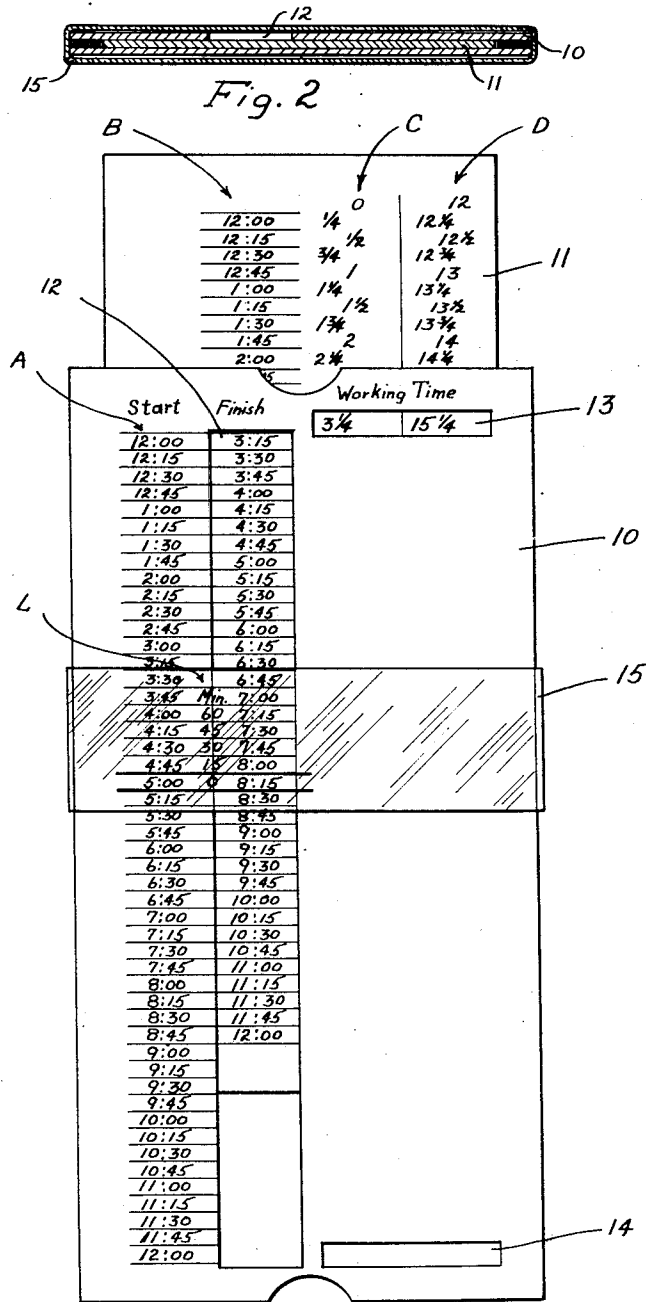


Fig. 1

INVENTOR  
E. W. Heerich

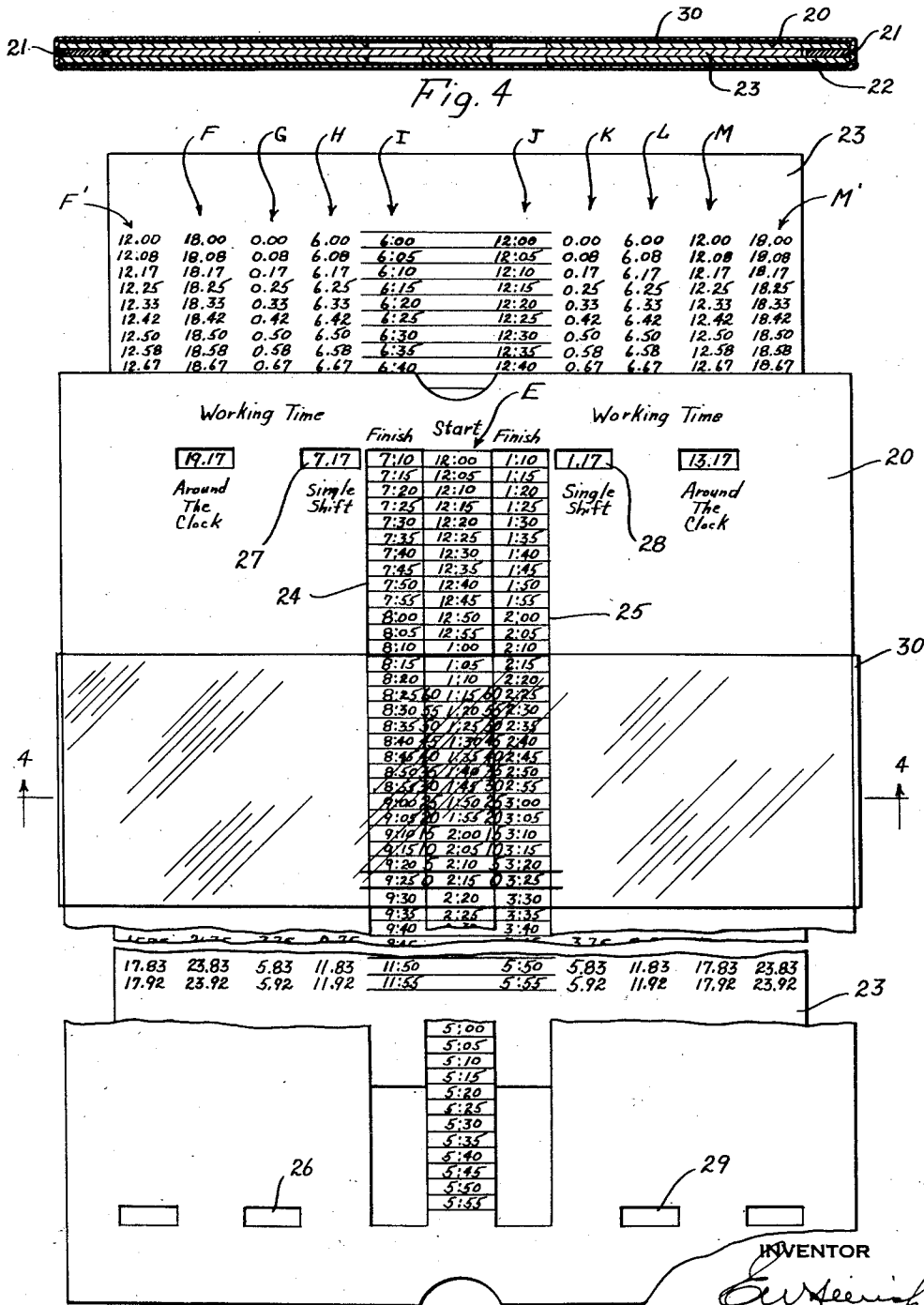
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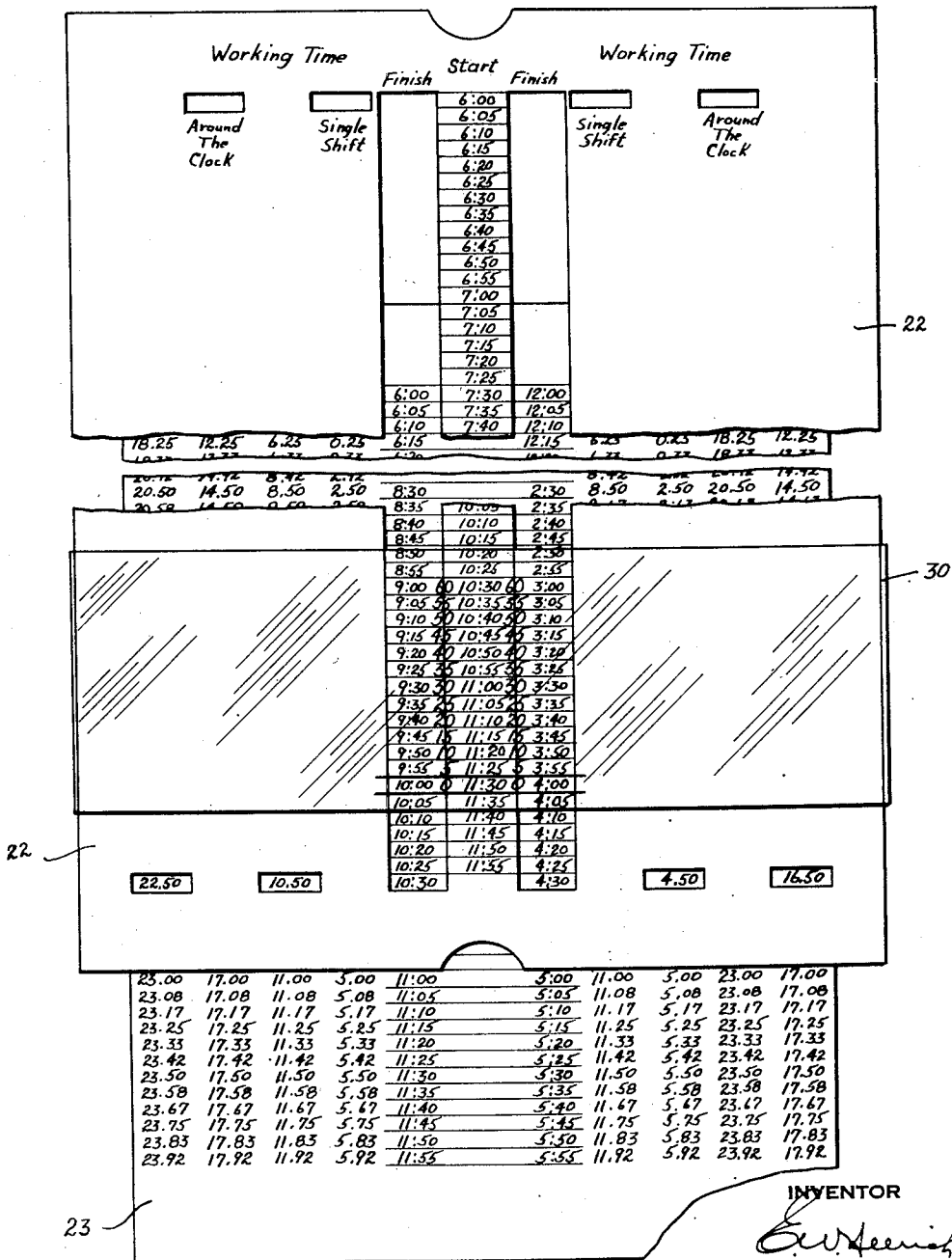


Fig. 5

INVENTOR

*E. W. Heerich*

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## CALCULATING DEVICE

Edgar W. Heerich, Westfield, N. J.

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4 Claims. (Cl. 235—89)

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This invention pertains to calculating devices and more particularly to calculating devices of the slide rule type.

The problem of keeping time records for pay and accounting purposes has always been a tedious and time consuming job entailing considerable expense. It involves translating starting and finishing times into elapsed time in the form of hours and fractional or decimal portions of an hour. This becomes increasingly bothersome when the periods being recorded begin and end at irregular times as when an employee starts late or quits early, or changes jobs at irregular times during the day in cases where the time spent on each job must be recorded. Aside from the time consumed in calculating elapsed time mentally or by other methods now in use, it is a frequent source of error.

An object of this invention is to provide a calculating device of the slide rule type that will indicate the correct elapsed time by one setting when the starting time and finishing time are known.

Another object is to provide such a device that will account for a lost time period, such as a lunch period, between the starting and finishing times.

Another object is to provide a device of the type described that will read directly the elapsed time for less than twelve hours and for elapsed times between twelve and twenty-four hours.

Another object is to provide a device of the type described that is compact in size and convenient to read, and in which the elapsed time always appears in an upright position on the same face the scales are set from.

Another object is to provide a device of the type described in which it is impossible to read an incorrect answer because of improper assembly of the parts.

Other objects, features and advantages of the invention will appear or be pointed out as the description proceeds.

In the drawings forming a part hereof, and in which like reference characters denote corresponding parts in all the views:

Fig. 1 illustrates a simple form of the calculating device of this invention.

Fig. 2 is a sectional view taken along line 2—2 of Fig. 1.

Fig. 3 illustrates one side of a modified form of the invention.

Fig. 4 is a sectional view taken along lines 4—4 of Fig. 3.

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Fig. 5 illustrates the reverse side of the device of Fig. 3.

Referring now to Fig. 1, a body portion 10 is suitably constructed to receive a slide 11 by any of the well known forms of slide rule construction. The body portion in this case comprises two face plates separated by spacers. (Fig. 2.) On the face of the body 10 is a scale A representing twelve hours and subdivided into any convenient number of parts, such as the fifteen minute divisions illustrated. This is based on our conventional system of telling time by 12 hour cycles. Adjacent to scale A is a window 12. Two other windows 13 and 14, near the top and bottom respectively are provided in the face of the body 10.

The slide 11 bears three scales, one exactly like scale A and hereafter referred to as scale B, which is properly aligned to appear in window 12 of the body. The two other scales on the slide, denoted by letters C and D, represent the elapsed time to be determined and are properly aligned so one number from each scale appears in window 13 or window 14, depending on the slide setting. If scales A and B represent 12 hours, as illustrated, scales C and D also represent 12 hours. If scale A runs from 12 o'clock to 12 o'clock, scale B also runs from 12 o'clock to 12 o'clock, scale C from 0 to 12 hours, and scale D from 12 to 24 hours. Scales C and D, are preferably made to read in hours and fractional or decimal parts of an hour while scales A and B preferably read in hours and minutes.

In order to determine the time elapsed between some time on scale A and some other time on scale B, it is only necessary to set the slide 11 to a position in which the finishing time on scale B is opposite the starting time on scale A and the elapsed time will appear on scale C in window 13 or window 14 if less than 12 hours, or on scale D in window 13 or window 14 if between 12 and 24 hours. For example, referring to Fig. 1, should it be necessary to find the elapsed time between 5:45 and 8:15, set the slide so 8:15 on scale B is opposite 5:45 on scale A and find the elapsed time, 2½ hours, on scale C in window 13. For an around the clock shift the elapsed time of 14½ hours appears on scale D in window 13.

It should be noted that the scales need not be laid out to read in order from 12 to 12, but might start and end at any other convenient hour without departing from this invention. It is only necessary that scales C and D be properly correlated to indicate the correct elapsed time.

While the construction thus far described is

satisfactory if the work period is uninterrupted from start to finish, it is usually necessary to account for a lunch period or other lost time. To provide for this an outer slide 15 is added. This slide may be made of transparent material as illustrated or may be opaque with appropriate windows to expose the scales as necessary. This slide 15 bears scale L which represents the time out period (lost time), and when properly used with scales A and B permits the net time worked to appear in window 13 or 14.

Its proper use is as follows. Select the starting time on scale A and adjust the position of the outer slide 15 to align the starting time and the figure on scale L representing the length of the lunch period. Move the inner slide 11 until the finish time on scale B is aligned with the figure 0 on scale L. The net time worked now appears in window 13 or 14. Guide lines above and below figure 0 of scale L assist in the correct and rapid setting of slide 11.

For example let the starting time be 4:30, the lunch intermission 30 min., and the finishing time be 8:15. The slides are set as illustrated in Fig. 1 and the net elapsed time of  $3\frac{1}{4}$  hours appears in window 13.

The form of the invention illustrated in Fig. 1 is very satisfactory for the limited number of time subdivisions illustrated. However should it be necessary to determine elapsed time for smaller time subdivisions, for example five minute intervals instead of 15 minute intervals as shown, the slide rule of Fig. 1 becomes cumbersome, since each hour now is represented by 12 subdivisions instead of four. To keep the scales large enough to be easy to use, and at the same time to keep the whole assembly from becoming unwieldy, the modification shown in Figs. 3, 4 and 5 has been found very satisfactory. Instead of having all twelve hours on one starting time scale (scale A, Fig. 1) this scale may be divided into two or more parts when properly combined with appropriate finishing and elapsed time scales. The preferred form of the invention in which the starting time scale is divided, is illustrated in Figs. 3, 4 and 5. In this form the starting time scale represents six hours and there are two matching finishing scales each representing six hours which when taken together give a full twelve hours of finishing time, thus providing for every possible finishing time. For each finishing time scale there is a scale to read elapsed time less than 12 hours and one to read elapsed time between 12 and 24 hours. For the other six hours of possible starting times, a similar arrangement of scales is provided on the reverse side of the rule.

Referring to Figs. 3, 4 and 5, the structure shown comprises a front body portion 20, a pair of separators 21, a back body portion 22, and a slide 23. The separators are securely attached to both body portions. Appropriate windows are provided in the body portions for matching the scales and reading elapsed time.

For example, scale E (Fig. 3) denotes 6 hours of starting time in 5 minute intervals. On either side of this scale are windows, denoted, 24 and 25, through which scales I and J of the slide 23 are visible. Scale E denotes starting time and scales I and J denote finishing times. Scales I and J each denote 6 hours in five minute intervals, the same in that respect as scale E, but scale I runs from 6 o'clock to 12 o'clock and scale J from 12 o'clock to 6 o'clock. Therefore, using scales E and I or J, every possible finishing time

can be aligned with any starting time between 12 o'clock and 6 o'clock. For any selected starting time on scale E and finishing time on scale I, the elapsed time appears on scale G or H. These are also 6 hour scales in 5 minute divisions, but read directly in hours and decimal parts of an hour. Scale G goes from 0 to 6 hours, and scale H from 6 to 12 hours giving the full number of possible answers for less than 12 hours, elapsed time. The scales of course are properly aligned so the correct elapsed time becomes visible through window 26 or 27 depending on the slide setting. Similarly if the finishing time appears on scale J, the elapsed time appears on scale K or L in window 28 or 29. An additional pair of scales may be added on each side of the E scale to read elapsed times around the clock, that is, between 12 and 24 hours, or just two need be used (scales F and M) if the correct windows are used to read the answers. By the same reasoning scales G and K and scales H and L could be combined, but that has been found to be confusing.

Fig. 5 illustrates the other side of the slide rule of Fig. 3 and is used for starting times between 6 and 12 o'clock. It is based on the same principle as described above for Fig. 3 and is shown with the slide at such a setting that it projects from the bottom of the body.

By combining the scales of Figs. 3 and 5 into one two sided device, it becomes very handy and compact. In order to prevent the slide from being removed and replaced backwards, resulting in incorrect answers, the scales on opposite sides may be mis-aligned by half a column, so they will not show through the windows in the body if incorrectly assembled. In Figs. 3, 4 and 5, a transparent slide 30 carries auxiliary scales to allow for lost time in exactly the same way as described heretofore in connection with Fig. 1.

Other scales may be substituted for the elapsed time scales shown for giving answers above 24 hours, or for reading time costs directly provided a different scale is used for each hourly rate.

Various changes and modifications can be made, and some features of the invention can be used without others, without departing from the invention as defined in the claims.

I claim:

1. A calculating device of the slide rule type having a fixed part, a second part movable with respect to the fixed part, a first scale on the fixed part representing six hours, a second scale on the movable part representing six hours of a twelve hour period, a third scale on the movable part representing the remaining six hours of said twelve hour period, means for aligning any given point on said first scale with any given point on said second scale or with any given point on said third scale, a fourth scale on the movable part, an index on the fixed part, said index indicating a point on said fourth scale that represents the elapsed time between any point on said first scale and an aligned point on said second scale, a fifth scale on the movable part, and a second index on the fixed part, said second index indicating a point on said fifth scale that represents the elapsed time between any point on said first scale and an aligned point on said third scale.

2. A calculating device according to claim 1 having a similar set of scales and indices on its reverse side in which the first scale on the reverse side represents the remaining six hours of a

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twelve hour period from that represented by the first scale in claim 1.

3. A calculating device according to claim 1 having a similar set of scales and indices on its reverse side but having the first scale on the reverse side represent the remaining six hours of a twelve hour period from that represented by the first scale in claim 1, and having the scales on the opposite sides of the movable part in offset relation to prevent improper alignment of the scales of the movable part and the scales and indices of the fixed part when the movable part is improperly assembled in the fixed part.

4. A calculating device according to claim 1 having an auxiliary slide mounted to move with respect to the fixed part and having an auxiliary time scale on said auxiliary slide so positioned that any point on said auxiliary time scale can

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be aligned with any point on said first scale and simultaneously any point on said second scale or any point on said third scale can be aligned with any point on said auxiliary scale.

E. W. HEERICH.

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