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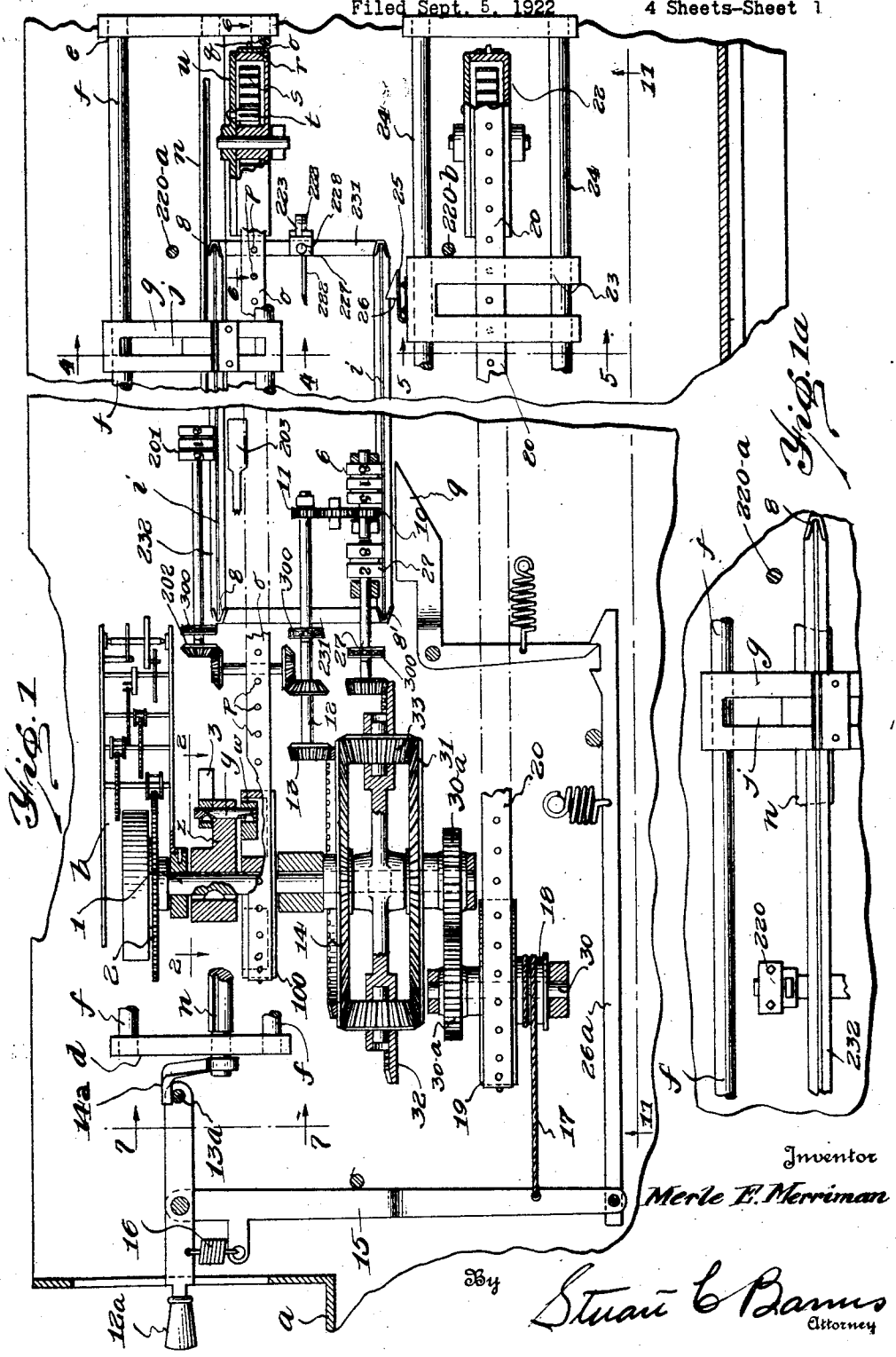
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M. E. MERRIMAN

ELAPSED TIME CALCULATOR AND PRINTER

Filed Sept. 5, 1922

4 Sheets-Sheet 1



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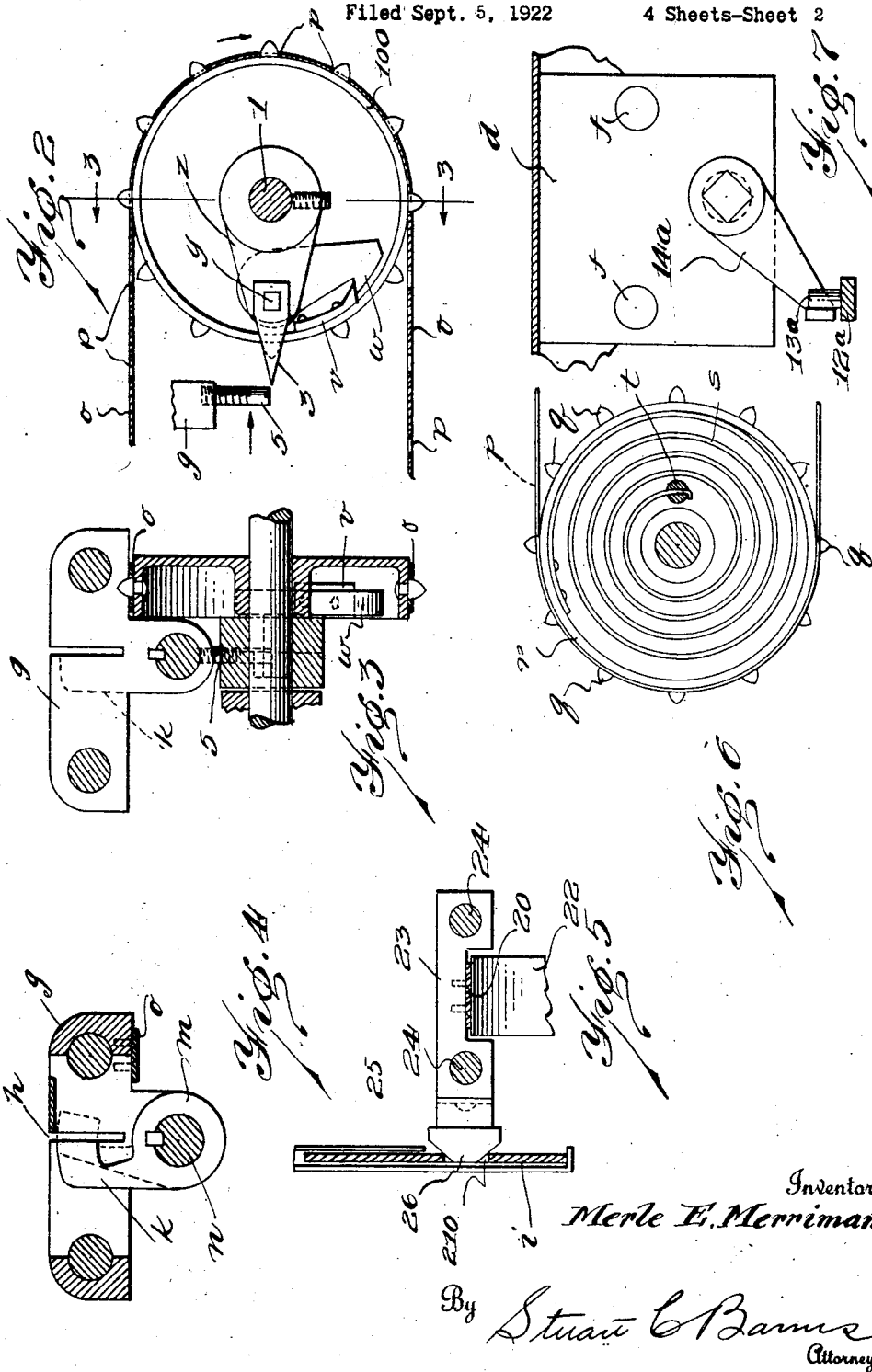
M. E. MERRIMAN

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ELAPSED TIME CALCULATOR AND PRINTER

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4 Sheets-Sheet 2



Inventor

Merle E. Merriman

By

Stuart C. Barnes
Attorney

Oct. 27, 1925.

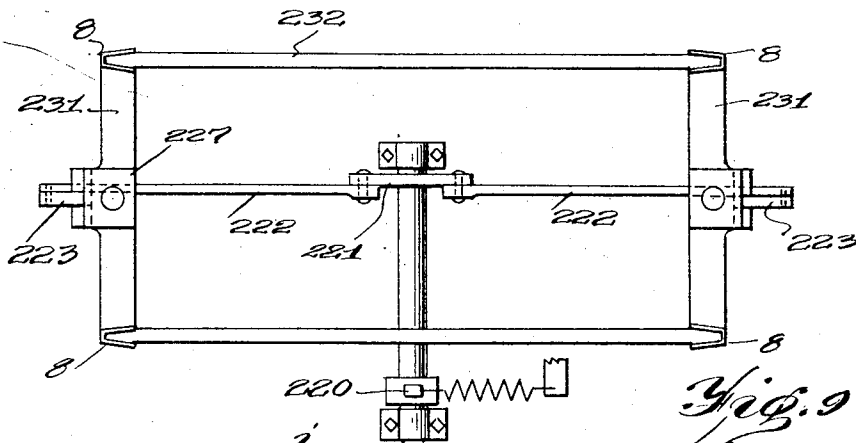
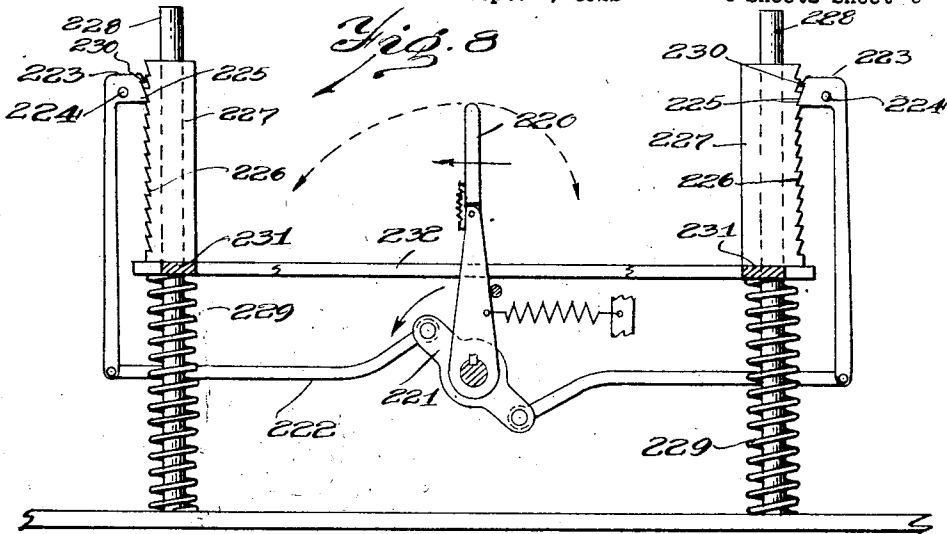
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M. E. MERRIMAN

ELAPSED TIME CALCULATOR AND PRINTER

Filed Sept. 5, 1922

4 Sheets-Sheet 3



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Inventor
Merle E. Merriman

By *Stuart C. Barnes*
Attorney

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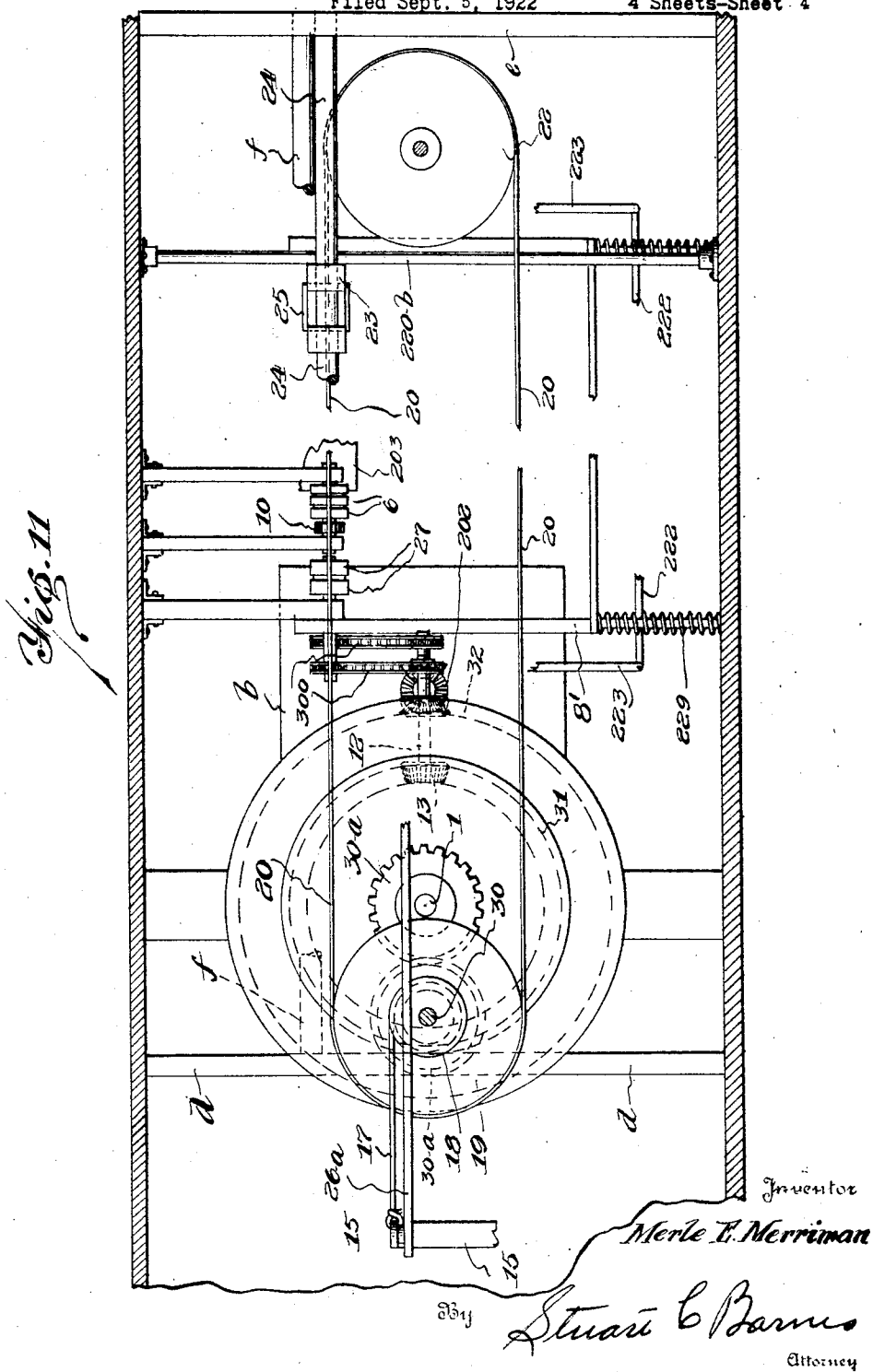
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M. E. MERRIMAN

ELAPSED TIME CALCULATOR AND PRINTER

Filed Sept. 5, 1922

4 Sheets-Sheet 4



Inventor

Merle E. Merriman

Stuart & Barnum

Attorney

UNITED STATES PATENT OFFICE.

MERLE E. MERRIMAN, OF DEER PARK, OHIO.

ELAPSED-TIME CALCULATOR AND PRINTER.

Application filed September 5, 1922. Serial No. 586,172.

To all whom it may concern:

Be it known that MERLE E. MERRIMAN, a citizen of the United States, residing at Deer Park, State of Ohio, has invented certain new and useful Improvements in Elapsed-Time Calculators and Printers, of which the following is a specification.

This invention relates to time clocks and especially to a time clock that is adapted to print elapsed time as well as the time of beginning work and the time of ceasing work.

So far as I am aware, no timekeeping apparatus and time printing apparatus has been designed which in its operation will not only compute but print elapsed time so that a complete record is furnished on the face of the card of the exact amount of time spent by the employee during a given period.

The various devices that go to make up the variety of functions necessary to accomplish the results in view will be best understood and may best be grouped in broad statements of novelty after the specific description has been given: In the drawings:

Fig. 1 is a plan view of the apparatus.

Fig. 1^a is a fragmentary plan view embracing a portion of the apparatus which is omitted in Fig. 1, because of the necessity of breaking the view transversely to get it on the sheet.

Fig. 2 is a section on the line 2—2 of Fig. 1.

Fig. 3 is a section on the line 3—3 of Fig. 2.

Fig. 4 is a section on the line 4—4 of Fig. 1.

Fig. 5 is a section on the line 5—5 of Fig. 1.

Fig. 6 is a section on the line 6—6 of Fig. 1.

Fig. 7 is a section on the line 7—7 of Fig. 1.

Fig. 8 is a side elevation of the automatic card-boosting apparatus.

Fig. 9 is a plan view of the same.

Fig. 10 is a view of the time card or pattern used.

Fig. 11 is a section on the line 11—11 of Fig. 1.

a designates the housing in which is contained the mechanism, *b* designates in a general way clock mechanism which is continuously running in a familiar way to keep

time. The dial is not shown as this is no part of the invention but of course it can be provided with a suitable dial and the housing may be shaped in a conventional way to properly expose the dial. Secured within the housing are a pair of uprights *d* and *e*. These uprights are connected by a pair of guide rods *f* on which slide a carriage *g*. This carriage is shown in Fig. 4 and comprises a block provided with a slot *h* adapted to straddle the bottom of the workman's card, which is designated *i* and shown in full lines in Fig. 1. This slide when viewed in plan view has a transverse slot *j*. In this slot the cutter *k* is arranged to rock. This cutter *k* is carried on a hub loosely splined on the key shaft *n*.

Fastened to the slide is a band *o* provided with suitable openings *p* arranged to fit over the studs *q* of the sprocket wheel *r*. This wheel *r* is provided with a spiral spring *s* anchored on the stationary pin *t* secured to the bracket *u*. The other end of the spring is riveted to the sprocket *r*. The opposite end of the band runs over a sprocket or driving wheel 100 provided with an internal tooth *v* adapted to be contacted by the driving pawl *w* (Fig. 2). This driving pawl *w* is secured on a rocking pin *y*, mounted to rock on the driving arm *z* keyed to the shaft 1 which is turned by the large gear wheel 2 of the clock mechanism. The driving wheel 100 is loose upon the shaft 1, consequently it is only driven through the pawl and tooth. However, the driving pawl *w* is connected up with the trip 3 on the opposite end of the rocking pin *y*. The purpose of this is to engage the depending pin or cam 5 of the carriage *g* when the carriage has completed its movement to the left in Fig. 1. This trip-pin 5 (see Fig. 2) rides on the top of the trip lever 3 consequently the trip moves downwardly removing the driving pawl *w* from the tooth *v*. This permits the spring *s* to rotate the sprocket *r* and by means of the band and sprocket 100, return the band and carriage to the starting position at stop pin "220". This again brings the internal tooth *v* into contact with driving pawl *w* so that motion is immediately imparted to carriage *g* along guides *f* as previously described without attention from the operator every 12 hours; however, any time interval can be used. The most practical construc-

tion would be to use 12 o'clock as the zero or starting point, the pin 220^a therefore stopping the carriage at a point registering 12 o'clock.

5 Referring to Fig. 1 the counter and printing wheels 6 which express current time are shown. They are three in number and are calculated to indicate and print the time at which the workman terminates his work.
10 These counter-wheels are connected in suitable series in a familiar way so that at a given point the unit wheel advances the tens wheel and the tens wheel advances the hour wheel one position. These features are common in connection with time clocks and
15 need no detailing. The time card *i* is inserted in the slot formed by the guides 8'. Now when the printing hammer 9 is tripped in a way presently to be described it will
20 be obvious that the card will be printed with the time on the time wheels 6 provided these are suitably inked by any suitable inking pad. The inking pad has not been shown as this is of ordinary construction and simply complicates the drawings.

25 The unit minute wheel is driven through the pinion 10, the driving gear 11 the shaft 12 and the bevel pinion 13. The bevel pinion 13 engages with the teeth on the back
30 of the driving gear 14, which is part of a differential presently to be described. This driving gear is driven directly from the clock shaft 1 because it is keyed to it. Now obviously these parts constitute a positive
35 driving connection between the unit minute wheel and the clock shaft and consequently the counter-wheels will always indicate the time of termination of the work, or in other words the "current time."

40 A similar arrangement of counter-wheels 201 and driving gears 202 may be coupled up with the clock mechanism to print the time of the commencement of work on the card, when the hammer 203 is actuated.

45 When the workman begins work he places the time-card *i* in the slot formed by the guides 8 and pushes the handle 12^a downward. That is shown in Fig. 1. The pin 13^a on the handle engages the crank 14^a
50 which is secured to the end of the key-shaft *n*. This obviously turns the key-shaft *n* which serves to turn the cutter *k* from the position shown in the full lines of Fig. 4 to position shown in the dotted line and
55 thereby punches a hole 210 in the card. This hole is at a predetermined point along the card, determined by the clock mechanism which as already explained drives the punching carriage along the card.

60 When the workman leaves his work he places the card *i* in the other card slot 8' and pulls toward him the lever 12^a for instance upwardly in Fig. 1. This lever 12^a is connected with a second lever 15 by a yieldable connection formed by the spring 16.

The resistance end of this lever is attached to a cable 17 that winds over the drum 18 which is connected with the driving wheel 19 over which runs the band 20. This band runs over the idler wheel 22 provided with
70 a spiral spring to always return the same to the initial position. Secured to this band is a follower block 23 which is guided on the rods 24 and arranged to slide therealong. This follower block is provided with a
75 spring dog 25 having an abrupt shoulder 26.

The follower block is stopped by the stop 220^b so as to position the spring dog at the zero point, that is, at a point corresponding to 12 o'clock.

80 When the workman pulls the lever 12^a upward this pulls on the cable 17 consequently through the connections already described pulls the band 20 to the left in Fig. 1 and also the follower block 23. However, the
85 spring dog 25 rubs along the time card until it strikes the hole 210 thereupon the shoulder 26 drops into the hole and arrests further movement of the follower block, because this resistance of the shoulder
90 and the card is greater than the strength of the spring 16, consequently the spring 16 yields but the movement of the lever 12^a is continued upward. This pulls the bell
95 crank hammer 9 to the left preparatory for a stroke. It will be noted that the spring dog travels a distance equal to the travel of the carriage *g* from the zero point to the time of beginning work. When the
100 draftrod 26^a slips off the end of the hammer, the hammer strikes the time-card and slaps it against not only the counterwheels 6 but also against the counter-wheels 27, which will now be described, and may be
105 broadly referred to as "time expression" means. These wheels 27 will be hours and tenths of hours but obviously any other division of time units could be employed. However, when the card *i* is slipped into its
110 slot and the lever 12^a pulled upwardly through the connections already described, the driving wheel 19 is actuated a given distance depending upon when it is arrested by the sliding block 23. This wheel 19 through
115 the shaft 30 and gears 30^a, is connected with the beveled gear 31 of the differential. Now obviously the large ring gear 32 of the differential which carries the pinions 33 will be rotated through the gear 31 and the
120 pinions 33 when the driving gear 19 is rotated through the upward movement of the lever 12^a, as already explained. The amount of this rotation is determined by the hole 210 in the card which arrests
125 the movement of the block 23. When a card that has been punched is inserted in the "quitting time" slot 8' and the operating lever pulled upwardly, the apparatus will subtract the starting time from the accrued
130 time which will be the elapsed time. It will

be noted that the wheels 27 are rotated with the clock mechanism to express current time. But as the gear 31 is actuated in the reverse movement as explained, the wheels 27 will be reversed and will be rotated an amount equal to the time interval between the zero point or 12 o'clock and the time of beginning work. This will leave precisely the time he has been at work and constitute an accurate calculation of the elapsed time. A further movement of the lever already referred to accomplishes the printing of this elapsed time and also the quitting time.

Now in considering the claims it will be evident there are certain broad instrumentalities cooperating to achieve the results sought, for instance, there are several main results, to wit: calculating elapsed time and printing elapsed time and calculating elapsed time and simultaneously printing both elapsed time and the current time. Now, in order to calculate elapsed time a pattern is necessary. This happens to be the workman's time card, the mechanism for cutting the hole in the card is the pattern maker which is controlled by the clock. The mechanism for responding to the control of the hole in the card is the pattern follower, and in this case, it is specifically the sliding block, the spring dog and the connections with the hand lever. The rest of the mechanism which achieves the elapsed time calculating and expressing is in part a subtracting instrumentality, more specifically described as operating on the differential drive principle. That is to say the clock work running continuously through one of the large gears of the differential establishes the minuend of the elapsed time calculating problem. The pattern maker, the pattern and the pattern follower determine the size of the subtrahend of the arithmetic problem. The actual movement of the pattern follower is accomplished by the hand lever and its connections, and coordinating with the differential it actually and mechanically subtracts the subtrahend from the minuend already referred to. This completes an absolutely accurate calculation of the elapsed time. To make the operation of the machine more simple the levers are so connected up by the connections already described to permit the latter part of the throw of the hand lever to operate the printing mechanism to take an impression from the counter-wheels showing the elapsed time. To further simplify matters contemporaneously the same printing operation takes the impression of the current time which becomes of course, as to this card, the ending time of the period for the employee.

In Figs. 8, 9, and 10, I have detailed the apparatus whereby the card at the end of each twelve hour period is boosted one line. The cutter-carrying carriage on its return

strikes the lever 220, this through the crank arms 221 and draft rods 222, rotates the two levers 223, on the pivots 224 and this withdraws the tooth 225 from the rack teeth 226, on the sliding blocks 227. These blocks slide on the post 228. The coil springs 229, immediately come into play and thrust the blocks up part of a notch where they are caught by the second tooth 230. When the lever 220 is released the tooth 230 is withdrawn, the tooth 225 is forced into engagement with the next tooth of the rack and the coil springs 229 thrust the sliding blocks the remaining portion of the notch, the tooth 225 then stopping the blocks. These sliding blocks are connected by the cross bars 231, with the card holder 232; consequently when the blocks advance one notch the card holder is boosted up one notch. This brings another line of the card in the path of the cutting punch and also the printing mechanism and the follower block arresting pawl. The lever 220 has an elbow which swings in only one direction, hence on the forward movements of the punch carriage the same passes inactively over the lever 220.

In Figs. 1 and 11, I show the sprocket chains 300 for connecting the driven printing rollers 6, 27 and 201 to the driving shafts, since these same rollers are positioned in a plane corresponding to the plane of the bands *o* and 20, while the driving shafts are located in the horizontal plane of the centerline of the differential.

In the operation of the machine, a time card is placed in slot 8, similar to the card shown in Fig. 10. It is understood that the clock mechanism is continuously running, thereby operating the band *o*, which carries with it the punch *k*. The movement of this punch *k* is so timed that it will travel a distance in twelve hours equal to the space on the card, which is graduated into twelve hours. When the card is placed in slot 8, the operator pulls the handle 12^a, towards him, or downwardly, as viewed in Fig. 1. This rocks the shaft *n* and causes the punch *k* to punch a hole in the card. When the operator quits work, he places the card in the slot 8'. He then actuates the handle 12^a in a reverse direction, or upwardly, as viewed in Fig. 1. This, through the yieldable connection 16 moves the arm 15 in a clockwise direction, thereby pulling on the cable 17 and rotating the drum 19. This moves the band 20, which is normally set at zero, or twelve o'clock. Carried by this band is a follower block 26, yieldably pressed in engagement with the card. Movement of the lever 12^a causes this follower block to travel across the face of the card until the block engages the hole previously cut in the card, which stops the movement of the band 20 at a point equal to the beginning time. The

differential connection between the pulley or drum 19 permits the wheels 27 to be reversed an amount equal to the beginning time. However, in the description, I have shown how these wheels 27 are so connected with the differential and the clock mechanism that they normally express the current time. Through reversing these wheels, an amount equal to the beginning time, it may be obviously understood that the wheels will now express the elapsed time or the amount of time which has elapsed between the beginning time and the quitting time. When the beginning time is punched on the card, the wheels 201 print the current time in the last column on the card. When the operator actuates the mechanism to record the quitting time, the wheels 6 print the quitting time and the time wheels 27 print the elapsed time in this last column. Every twelve hours the card carrier is automatically raised one notch when the card is inserted, the hole is punched in the correct day column, which is divided up into the A. M. and P. M. periods.

What I claim is:

1. In an apparatus for the purpose specified, the combination of a time keeping instrumentality, a time expression instrumentality controlled thereby, a pattern, means for recording the beginning time and quitting time of a working period on the pattern, a pattern forming mechanism for marking the pattern in accordance with the beginning time, a differential driving mechanism connecting the time expression instrumentality and the time keeping instrumentality, whereby the former normally expresses current time, means for reversing the movement of said differential driving mechanism which includes a movable band and a pattern follower carried thereby, whereby the pattern follower engages the mark on the pattern made by the pattern forming mechanism to limit the reverse movement of said differential, and time expression instrumentality to an amount equal to the beginning time for the purpose of subtracting the beginning time from the quitting time to calculate the elapsed time.

2. In an apparatus for the purpose specified, the combination of a time keeping instrumentality, a time expression instrumentality controlled thereby, a pattern, means for recording the beginning time and quitting time of a working period on the pattern, a pattern forming mechanism for marking the pattern in accordance with the beginning time, a differential driving mechanism connecting the time expression instrumentality and the time keeping instrumentality whereby the former normally expresses current time, means for reversing the movement of said differential

driving mechanism which includes a movable band and a pattern follower carried thereby, whereby the pattern follower engages the mark on the pattern made by the pattern forming mechanism to limit the reverse movement of said differential when the same has been reversed an amount equal to the beginning time, for the purpose of subtracting the beginning time from the quitting time to calculate the elapsed time, and a spring for returning the band thereby returning the time expression instrumentality to normal position for again expressing current time.

3. In an apparatus for the purpose specified, the combination of a time keeping instrumentality, a time expression instrumentality controlled thereby, a pattern, means for marking the pattern to record the beginning time and quitting time of a working period, a differential driving mechanism connecting the time expression instrumentality and the time keeping instrumentality whereby the former normally expresses current time, means for reversing the movement of said differential driving mechanism, including a pattern follower engaging with mark on said pattern for controlling the reverse movement of said differential in accordance with the recorded beginning time in order to subtract the beginning time from the quitting time to calculate the elapsed time, a spring for returning the pattern follower, and a stop to limit the return movement of said pattern follower in order to position the same at a zero point.

4. In an apparatus for the purpose specified, an elapsed time calculating and expressing mechanism, including a pattern forming mechanism comprising a band driven by clock mechanism, a travelling carriage driven by the band and including a punch, means for holding the pattern stationary with respect to the punch and means for actuating the punch for cutting a hole in the pattern.

5. In an apparatus for the purpose specified, an elapsed time calculating and expressing mechanism, including pattern making mechanism, which comprises a time keeping mechanism, a band driven thereby, a carriage carrying a punch secured to the band, and means for automatically returning the carriage to its original position at given periods.

6. In an apparatus for the purpose specified an elapsed time calculating and expressing mechanism, including pattern making mechanism, which comprises a time-keeping mechanism, a band driven thereby, a carriage carrying a punch secured to the band, and means for automatically returning the carriage to its original position at given periods consisting of a detachable driving connection between the time mech-

anism and the band, a spring and a trip mechanism operated by the carriage to disengage the detachable driving connection and permit the spring to return the carriage to its initial position.

7. In an apparatus for the purpose specified, means for calculating and expressing elapsed time, including a pattern making mechanism having in combination a time keeping mechanism, a pair of sprocket wheels, a band running over the sprocket wheels, a detachable driving connection between the time-keeping mechanism and one sprocket wheel comprising a tooth and driving pawl provided with a trip, a punch carrying carriage secured to the band, suitable means for actuating the punch, a spring in the other sprocket wheel and a cam on the carriage for engaging the trip to disconnect the driving connections and permit the spring to return the carriage to initial position.

8 In an apparatus for the purpose specified, means for calculating and expressing elapsed time, including a pattern follower and a pattern holder, a sliding block provided with a spring dog adapted to drop into a hole in the pattern to arrest the travel of the sliding block and means connected with the block for driving the calculating devices in the reverse direction to subtract the time of beginning work.

9. In an apparatus for the purpose specified, the combination of means for calculating and expressing elapsed time, including a traveling punch carriage and means automatically operated by said punch carriage for shifting the time card to bring another space of the card within the zone of operation of the punch.

10. In an apparatus for the purpose specified, the combination of means for calculat-

ing and printing elapsed time, including a travelling punch carriage that is periodically returned to its initial position, and means automatically operated by the punch carriage on its return from its extreme position of travel for automatically shifting a time card to bring another space of the time card within the zone of operation of the printing mechanism.

11. In an apparatus for the purpose specified, means for calculating and expressing elapsed time, including a traveling member, and means for shifting the card actuated by the traveling member, including card holders having connections with a pair of racks and one or more double tooth levers constituting an escapement, means for rocking the levers automatically operated by the traveling member, and springs for shifting the card holders when the escapement temporarily releases the card holders.

12. In an apparatus for the purpose specified, the combination of a time keeping instrumentality, a time expression instrumentality controlled thereby, means for recording the beginning and quitting time of a working period, a differential driving mechanism directly connected to said time keeping instrumentality and to said time expression instrumentality, whereby the time expression instrumentality normally expresses current time, and means for reversing the movement of said differential while in direct connection with said time keeping instrumentality, whereby the time expression instrumentality may be reversed an amount equal to the beginning time to calculate the elapsed time.

In testimony whereof I affix my signature.

MERLE E. MERRIMAN.