

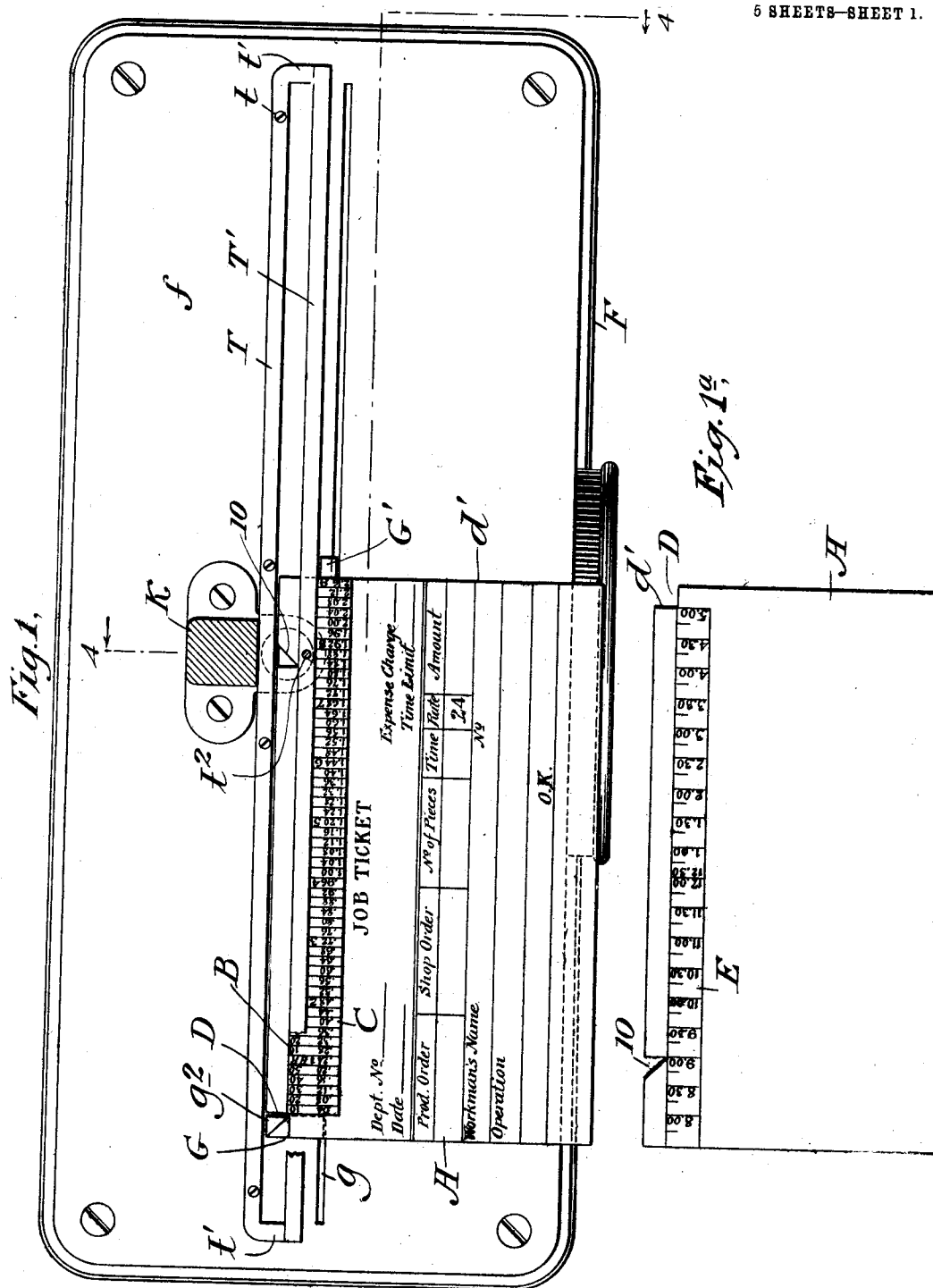
METHOD OF CALCULATING AND MAKING UNALTERABLE RECORDS.

APPLICATION FILED JUNE 9, 1910.

Patented June 24, 1913.

5 SHEETS—SHEET 1.

1,065,501.



Witnesses:
Edward Thorpe.
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1,065,501.

6 SHEETS—SHEET 2.



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5 SHEETS—SHEET 3.

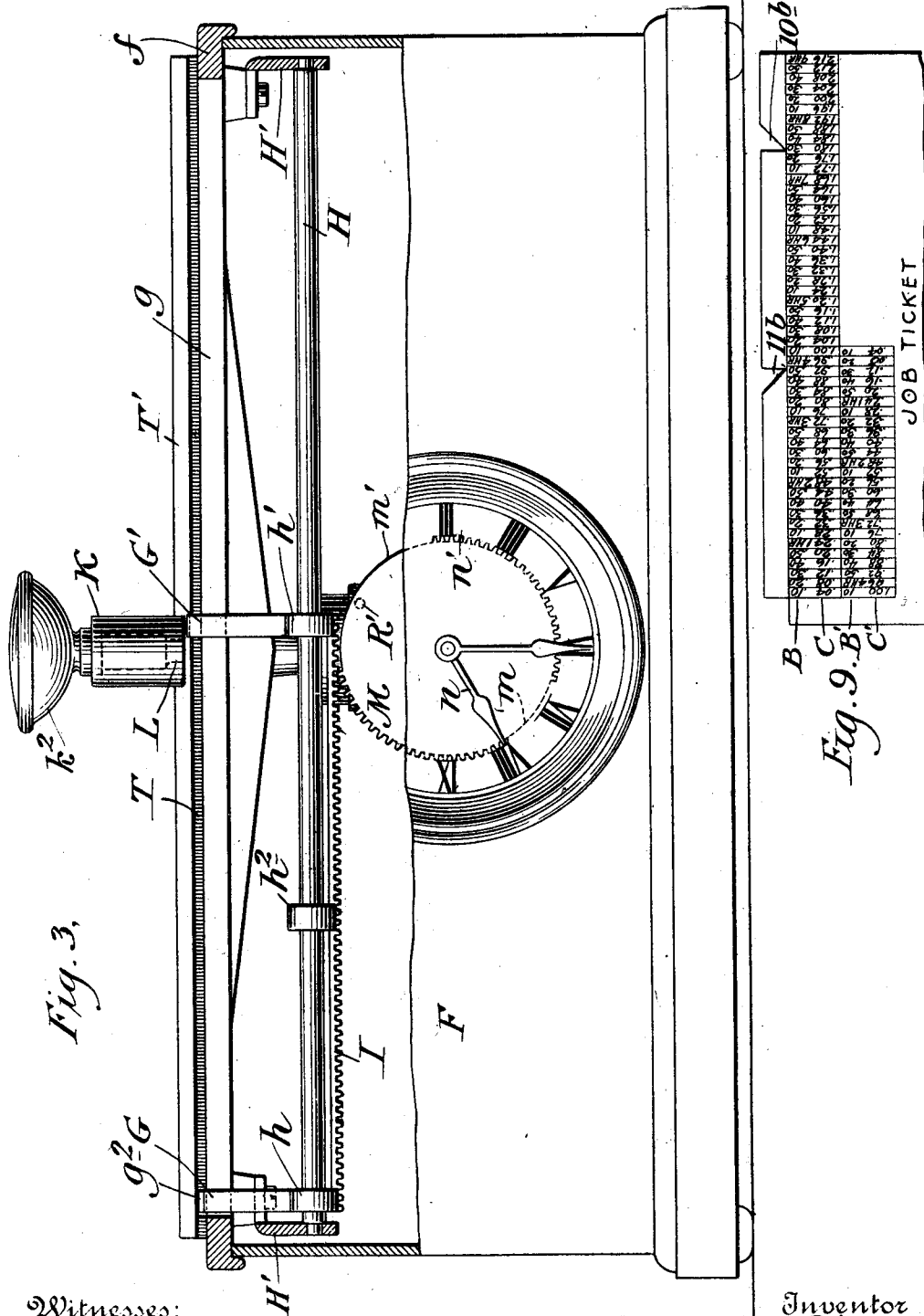


Fig. 3.

106

106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
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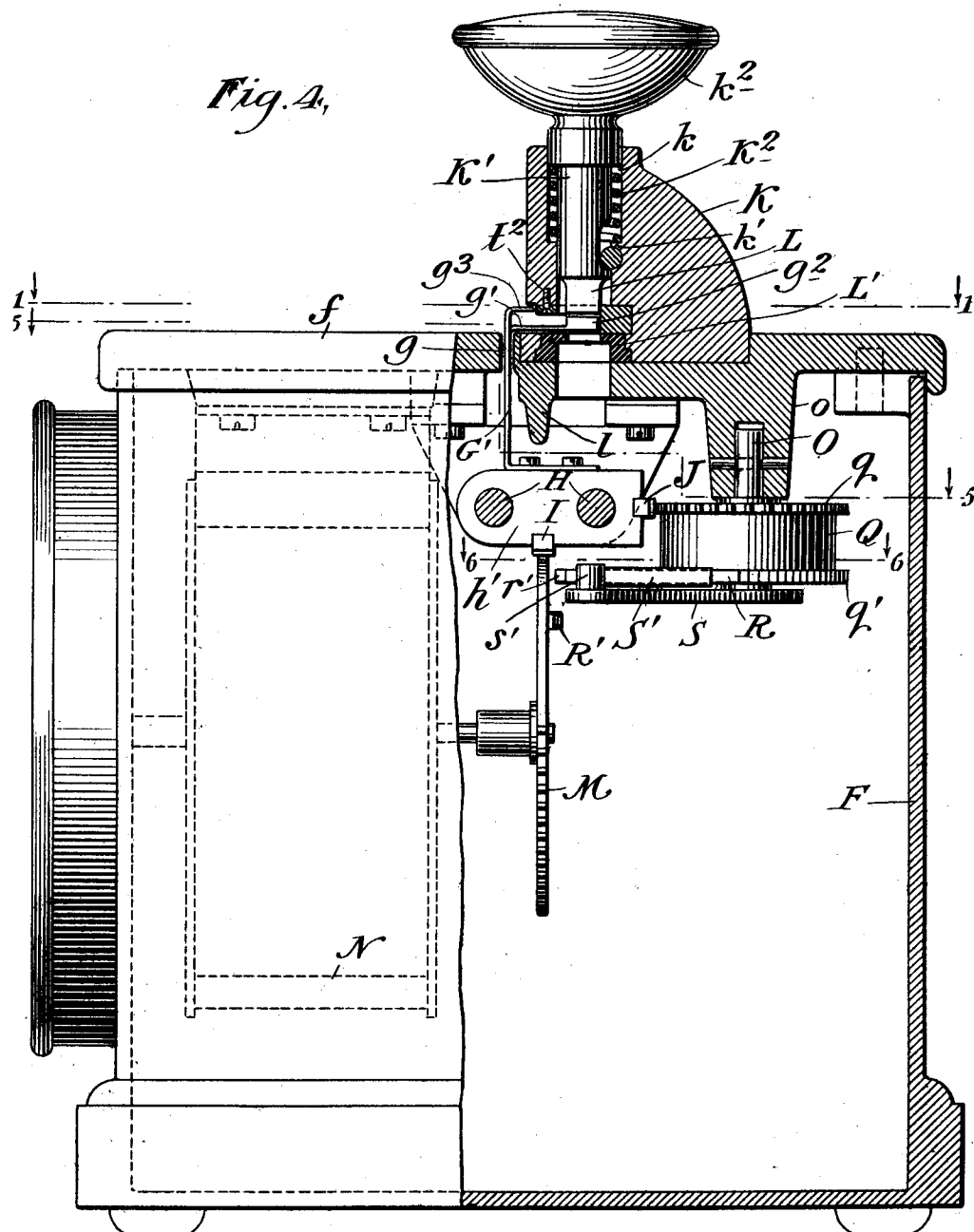
JOB TICKET

Fig. 9.B.

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5 SHEETS-SHEET 5.

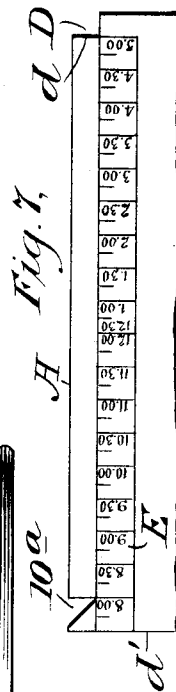
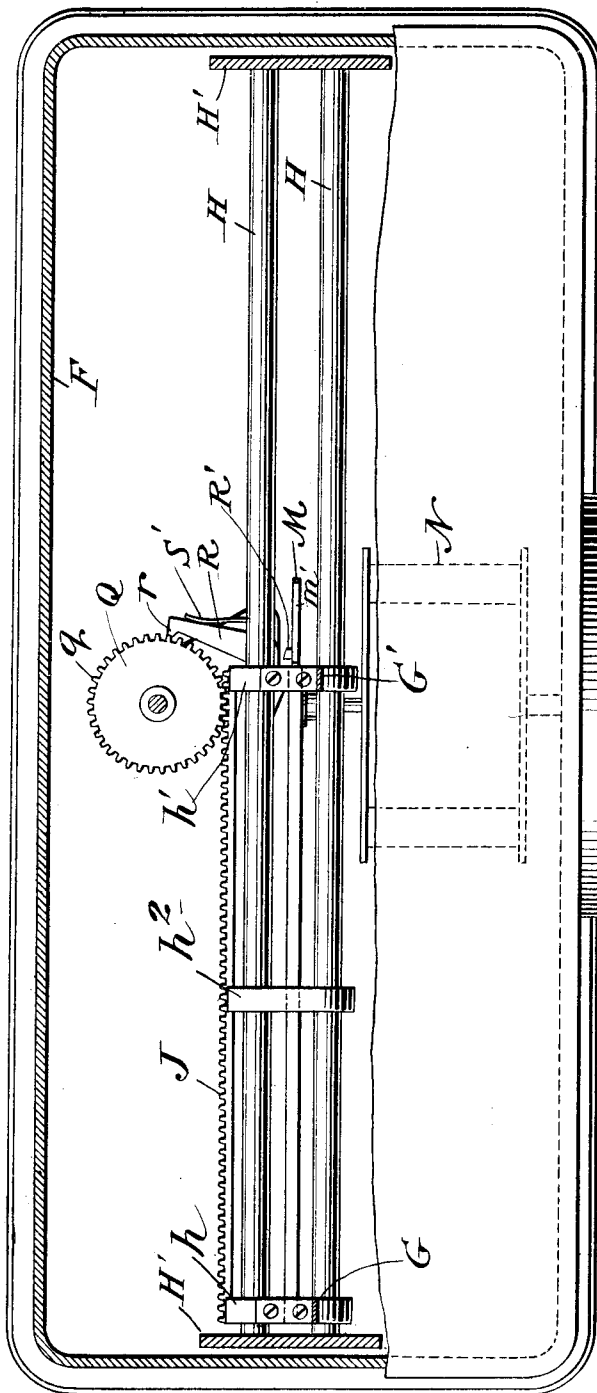
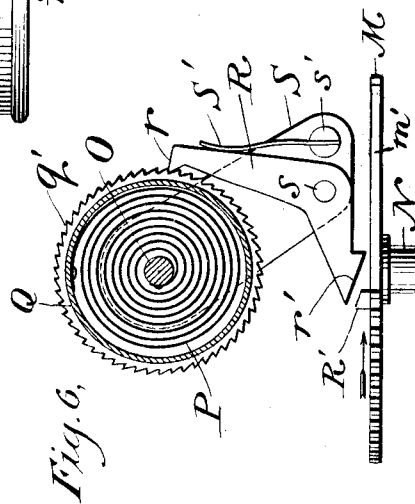


Fig. 8. A 10a

Dept. No	a	C	a	JOB TICKET	Expense Charge
0.00					
0.01					
0.02					
0.03					
0.04					
0.05					
0.06					
0.07					
0.08					
0.09					
0.10					
0.11					
0.12					
0.13					
0.14					
0.15					
0.16					
0.17					
0.18					
0.19					
0.20					
0.21					
0.22					
0.23					
0.24					
0.25					
0.26					
0.27					
0.28					
0.29					
0.30					
0.31					
0.32					
0.33					
0.34					
0.35					
0.36					
0.37					
0.38					
0.39					
0.40					
0.41					
0.42					
0.43					
0.44					
0.45					
0.46					
0.47					
0.48					
0.49					
0.50					



Witnesses:
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Fig. 5,

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UNITED STATES PATENT OFFICE.

CLARENCE A. BISHOP, OF NEW YORK, N. Y.

METHOD OF CALCULATING AND MAKING UNALTERABLE RECORDS.

1,065,501.

Specification of Letters Patent.

Patented June 24, 1913.

Application filed June 9, 1910. Serial No. 565,959.

To all whom it may concern:

Be it known that I, CLARENCE A. BISHOP, a citizen of the United States, residing in the city of New York, borough of Brooklyn, county of Kings, and State of New York, have invented a certain new and useful Method of Calculating and Making Unalterable Records, of which the following is a specification.

This invention is a method of calculating and making unalterable records, and while it is particularly adapted for obtaining permanent and accurate records of factory costs and wages, it is adapted, also, for various uses in offices, factories, and other business establishments, since it enables elapsed time and wages to be calculated automatically, *i. e.*, without necessitating any calculations independently of the data given directly by the machine used in carrying out the method.

In many factories, and other places of business, each job passes through a number of operations, and these operations may be, and generally are, performed by different workmen, with or without the aid of machinery. It is manifest that it is particularly desirable to ascertain the labor cost on each job or operation. In most factories this is quite laborious and expensive, for the reasons, mainly, that the workmen are paid different rates of wages per hour, and the time consumed in the different operations by the various workmen varies within wide limits.

Various mechanical appliances and business systems have been devised and are in use for securing records on cards or otherwise from which the labor cost may be tabulated and computed, but there are many objections to the appliances heretofore proposed or now in use, among which are, particularly, the cost of the machines used, the complicated character of the systems, and the expense attending the calculation of the time and wages from the data obtained on the cards.

In practising the present invention an apparatus of low initial cost is employed, and the method renders it perfectly feasible to secure in a simple manner an accurate and unalterable record of the labor cost on each job, or part thereof, such records being made by the workmen and without loss of time. These records disclose, upon mere inspection,

the time an employee has worked, and his wages at a predetermined rate, thereby practically eliminating the expense and labor now incident to determining the elapsed time and wages.

In the preferred way of practising the process I employ a record card on the face of which are provided two parallel columns of figures, one for indicating elapsed time in hours and fractions thereof, and the other the wages to be paid to the employee, at a given rate, for such elapsed time. On the reverse side of the card, termed the back, and directly under the column indicating the time, is a column of figures denoting the hours of the day and fractions thereof, the figures on this scale running in an opposite direction to the figures of the time scale on the face of the card, the function of this scale being to show the hour or fraction thereof when the employee began work.

Each employee is supplied with record cards of the character described, the wage column on the face of which indicates the particular rate of wages per hour he is to receive. These cards may be given to him by the foreman or time-keeper at the commencement of a job, or operation, and by means of the time controlled mechanism employed in practising the invention, the card is at proper times suitably marked, stamped or punched, preferably with two holes or recesses, or by notching or otherwise cutting away parts of the card.

Broadly stated, the method consists in providing a card of any desired shape having on the face thereof a time scale and a rate scale, these scales being straight, circular, or otherwise, and in the preferred form of the card, there is also provided, on the back thereof, a time scale, the units of which run in the opposite or reverse direction from those of the time scale on the face of the card; moreover, this card is also, preferably, provided with a notch, recess or other mark which forms a permanent index thereon; the said card is then positioned with reference to a movable member, such as a marker, punch, carriage or guide, and suitably punched, recessed, perforated or otherwise marked for the purpose of producing thereon an index adapted to determine the position of the card for again punching or marking the same at a subse-

quent period; in the form of card referred to wherein a time scale is employed on the back thereof, the said punching or marking operation, in addition to establishing an index, shows, also, on said scale the time at which the card was marked or punched, *i. e.* the time when the employee began to work; at a time subsequent to the first marking or punching operation, usually the time when the employee stops work or completes a given job, the card is again positioned with its facial time and rate scales in coöperative relation with the movable member referred to above, *i. e.*, the marker, punch, carriage or guide, and again punched or otherwise marked; as will appear from the hereinafter description, the card, in one form of apparatus used in practising the invention, is reversed end to end and face to face before the second punching or marking is effected, whereas, in other types of apparatus employed, such reversal of the card is not necessary; the second punching or marking having been effected, the elapsed time between the first and second of such operations may be read directly from the time scale on the face of the card, and the wage or other charge corresponding to such time may be directly read on the rate scale.

It will thus be seen that the novel method embraces a series of operations, some of which are performed manually and others by mechanism of one type or other, the salient feature of which mechanism is a time train, and that the complete method is simple, expeditious, and eminently practical, and produces results not heretofore attainable in the art of calculating.

The method not only produces absolutely accurate and reliable calculations, but, also, is available in producing unalterable records on time cards.

In the accompanying drawings I have illustrated a practical embodiment of a machine or apparatus which is adapted to be employed in practising my method, wherein—

Figure 1 is a plan view, partly in horizontal section, illustrating a card positioned face uppermost in the machine, said card being positioned for the first punching or marking operation, the plane of the section through the machine being indicated by the dotted line 1—1 of Fig. 4. Fig. 1^a is a plan view of the card punched by the machine when the card is in the position of Fig. 1 but showing the back or reverse side of the card and the time scale on the back thereof, for the purpose of indicating the time at which work was commenced in a particular job or piece of work. Fig. 2 is a view of the machine similar to Fig. 1, showing the card guide or holder advanced by the time mechanism to a certain position and beyond the position shown in said Fig. 1, the punched

card of Figs. 1 and 1^a being reinserted in the machine of Fig. 2 for the second punching or marking operation, said card at the second insertion into the machine being reversed end for end and face for face prior to said second punching or marking operation. Fig. 2^a is a face view of the card shown in Figs. 1, 1^a, and 2 after said card shall have undergone the punching or marking operation, whereby the elapsed time and the value thereof are readable directly from the face of the card, at the punch or mark nearest the zero end the time scale on the back of the card indicating by the punches or marks the hours, or fractions thereof, when the work was begun on a particular job. Fig. 3 is a front view of the machine illustrated in Figs. 1 and 2, certain parts of said machine being broken away and shown in section. Fig. 4 is a vertical cross-section, partly in elevation, the plane of the section being indicated by the dotted line 4—4 of Fig. 1 looking in the direction of the arrow. Fig. 5 is a plan view, partly in horizontal section, of the machine omitting the card, the plane of the section being indicated by the dotted line 5—5 of Fig. 4. Fig. 6 is a horizontal section on the line 6—6 of Fig. 4, illustrating a locking and releasing mechanism for a spring-actuated drum, the latter being adapted for returning the card guide or holder to a position for beginning operation at the commencement of another day's work. Fig. 7 is a view of the reverse of another record card illustrating the punching thereof at the beginning of a day's work, say at 8 a. m. Fig. 8 is a face view of the card shown in Fig. 7 after the same shall have been punched the first and second times by the machine, to show the elapsed time and the value thereof on the face of the card and on the back of the card the hours, and fractional parts thereof, when the work was begun on a particular job; the punchings or markings in Figs. 7 and 8 differing from the card shown in Figs. 1^a and 2^a in order to furnish other examples of the records adapted to be produced by my invention. Fig. 9 shows a particular form of premium card which may be used for calculating certain specific data.

According to the preferred form of my invention wherein all the markings are by punches mutilating the record cards and such punchings are performed by one machine, each employee is supplied with a record card, A, for each job upon which he is to work. The card may be composed of any material suitable for the purpose, such as paper, and it is of a desired form and size, such as the substantially rectangular card shown in Figs. 1, 1^a, 2, 2^a, 7, 8 and 9, although the shape of the card is not a material factor, for the reason that other shapes may be employed, such as circular cards.

The card is provided on its face with two scales, B, C, which are shown as parallel and quite close to a side edge of the card, although the particular arrangement may be varied as desired, the scale, B, designating the time in hours and fractions thereof, termed herein the elapsed time scale, and the other scale, C, designating wages at a predetermined rate. The face of the record card is shown in Figs. 1, 2^a and 8, and the back in Figs. 1^a, 2 and 7. As shown, the face of the card is provided with parallel lines, *a*, *a*, intersected by cross lines, *a'*, and in the divisions or spaces thus formed are the figures of the elapsed time scale, B, and the figures of the wage or rate scale, C. The column of figures B, represent the time in hours and fractions thereof, each hour being divided into six equal parts, representing periods of ten minutes, although the special division of the hours is optional. The column of figures, C, represent the value of the wages at a predetermined rate, and said figures are set opposite to the figures in the elapsed time scale, said figures of column, C, being divided to show the amounts in dollars and cents for every ten minutes indicated in column, B.

In addition to the elapsed time scale, and the rate scale, the record card is shown as being provided on its face with appropriate data for identifying the workman, the particular job on which he is to be engaged, the shop order, the department number, the date, and other desirable facts; but as these factors have no bearing on the invention and may be omitted, altered and varied within wide limits, I do not deem it necessary to refer more particularly thereto. Other desirable, although not essential, features of the record card are, first, a permanent guide or index, D, and, second, a time scale, E, on the back of the card, the latter being shown in Figs. 1^a, 2 and 7.

The permanent guide or index, D, is shown as a notch in one corner of the card, the function of said guide or index being to compel the workman to insert the card properly into the machine for the first punching or marking operation, the latter being performed to denote, first, the time at which work was begun on the particular job, but, mainly, for the purpose of furnishing a guide for the proper insertion of the card, at the completion of work on the job, in order that the second punching or marking operation may be performed on the card, all as will hereinafter appear.

The time scale, E, on the back of the card, see Figs. 1^a, 2 and 7, is shown as being positioned below or opposite to the scales, B, C, on the face, although the position of said time scale, E, is immaterial, for the reason that it may be provided on any part of the card, as *e. g.* on the face thereof. The scale,

E, denotes the hours and fractions thereof, and the figures of this scale increase or run in an opposite direction from the corresponding figures in the elapsed time scale, B, on the face, as will be seen by a comparison of Fig. 1^a with Fig. 1, or Fig. 2 with 2^a, or Fig. 7 with 8.

Having described one form of record card suitable for carrying out my process, I will next proceed to set forth a machine by which all the necessary marking or punching operations may be performed upon such a card, the latter being manipulated in a particular manner, whereby unalterable and accurate records are adapted to be produced, such records being readable directly from the cards, and without the necessity of performing any calculations whatever by the book-keeping or time-keeping departments of the factory, etc.

Referring to Figs. 1, 2, 3, 4, 5 and 6, the machine is shown as having a casing, F, within which is contained some of the operating mechanism. As shown, the casing is oblong in shape in order to provide for the necessary travel of the card holder or guide adapted to be moved at a certain rate of speed with reference to a marking or punching mechanism by a time train. The top, *f*, of the casing is provided with a longitudinal slot, *g*, and in this slot travels two members, G, G', of the card guide or holder. Said members, G, G', are fastened at the lower ends to cross-heads, *h*, *h'*, respectively, and said cross-heads are fitted slidably on guide rods, H, see Figs. 3, 4 and 5. Three cross-heads indicated at *h*, *h'*, *h*², are employed, and they are connected for simultaneous movement by racks, I, J. All the cross-heads are fitted slidably on guide rods, H, the cross-head, *h*², occupying a position intermediate of cross-heads, *h*, *h'*. The series of cross-heads and racks, I, J, connected therewith, constitute what may be termed a sliding carriage for members, G, G', of the card guide or holder. As shown rods, H, are secured at their ends in hangers, H', which are fastened to top, *f*, of the casing, said hangers operating to support the guide rods in fixed positions below the top and in parallel relation. The rods are shown in Fig. 4 as circular in cross section, and cross-heads, *h*, *h'*, *h*², are provided with circular openings so that they may slide upon the rods.

Member, G, of the card guide or holder is shown as consisting of a metal strip attached rigidly at its lower end to cross-head, *h*, and passing upwardly through slot, *g*. The upper part of the member, G, is bent to produce an arm, *g'*, which extends part way across the top, *f*, and at the free end of this arm there is provided an upstanding stud or lug, *g*², the shape of which is shown more particularly in Figs. 1 and 2. The upstanding stud or lug, *g*², corresponds in shape to

the hole or recess which is produced in the record card by the operation of a male die or punch, presently described, and while the male die and the upstanding lug, g^2 , may be of various shapes, said die and the lug or stud, g^2 , are herein shown as being substantially triangular. The other member, G' , of the card guide or holder is shown in Fig. 4 as consisting of a flat strip secured firmly at its lower end to cross-head, h' , and extending upwardly therefrom through the slot, g , in the top of the casing. The upper extremity of member, G' , is shown as having a short angular arm, g^3 , positioned to travel quite close to an edge of one rail, said rail cooperating with another rail for positioning the card below a marking or punching mechanism.

It should be remarked that the distance between the inner edges of members, G , G' , forming parts of the card guide or holder, is equal to, or but slightly exceeds that of, the length of the card, A , along that edge thereof between the end edge, d' , of the card and the edge, d , of notch, D , said edge, d , of the notch being parallel to the edge, d' , of the card as shown. It is apparent that card, A , prior to the first marking or punching operation, is adapted to be positioned in a definite relation to members, G , G' , of the card guide or holder, and, accordingly the card cannot be introduced into the machine except the notched corner, D , of the card engages with stud, g^2 , of member, G . When introducing the card into the machine for the first operation, the workman is required to place said card face uppermost upon the top, f , of the casing and in a position for notch, D , to receive stud, g^2 , of member, G , the other end edge, d' , of the card engaging with one edge of member, G' , as clearly shown in Fig. 1. When so positioned the card lies below the punching mechanism and it is adapted to be punched or recessed along that edge of said card having notch, D , whereby the punch or other mark produced on the card will be adjacent to the scales with which said card is provided.

The mechanism shown in the drawings for providing the indications on the card by two distinct operations and separated by an appreciable interval of time, embodies a punch occupying such position with reference to the path of the card guide or holder that said punch will operate to produce an aperture or recess in the card when placed in proper position between the members of the card guide or holder and below said punching mechanism. A stand, K , is fixed to the top of the casing, F , and at a point adjacent to slot, g , therein. Said stand is provided with a vertical bore or passage, k , having a shoulder, k' , and within this bore or passage operates a plunger, K' , the upper end of which is provided with a head or

pressure piece, k^2 . The plunger is lifted to a raised position by a spring, K^2 , incased within the bore or passage of the stand, the lower end of the spring being seated upon the internal shoulder, k' , and the upper end of said spring acting against the head of said plunger. The plunger carries, or is provided at its lower end with, a male die, L , which is adapted to cooperate with a female die, L' , the latter being secured to the top, f , preferably flush therewith, as shown in Fig. 4. The chambered part of stand, K , overhangs the female die and the path of the card holder or guide, there being a space provided between the female die and the male die when the latter is raised by the action of the spring upon the plunger, whereby a card may be positioned between the male die and the female die. As heretofore described, the male die may have any desired external contour, but preferably said male die is triangular in cross section so as to conform to the triangular shape of stud, g^2 , of member, G , of the card guide or holder. The female die is provided with an opening which conforms to the shape of the male die, and said female die is shown in Fig. 4 as having a passage for the escape of the material cut out of the cards by the action of the cooperating dies. When the punching mechanism operates upon a card, a tapering notch or recess is cut in an edge portion of said card, as shown in Figs. 1^a, 2^a, 7 and 8 of the drawings, the apex of the triangular notch or recess pointing to at least one of the figures of the scale, B , indicating elapsed time and one of the numbers in scale, E , indicating the time at which the operation on a particular job was commenced. The perforation or recess produced in the card by the operation of the punching mechanism has a definite relation to the scales provided on the face and back of the card.

As shown in Fig. 4, the top, f , of the casing is provided on its under side with a reinforcing rib, l , extending from end to end of the top and adjacent to slot g .

The rack, I , forming a part of the carriage for the members, G , G' , of the card holder, is shown as a straight bar secured to the lower edges of cross-heads, h , h^2 , the lower edge of said bar, I , being provided with gear teeth, said gear teeth extending continuously with respect to the bar, see Fig. 3. Said rack, I , cooperates with a driving member, M , operated by a time train of any suitable character. Said time train is indicated in dotted lines in Figs. 4 and 5 by reference character N , and in addition to imparting rotary motion to driving member, M , the time train operates the hour and minute hands, n , which traverse the clock dial, n' , said dial and hands of the time clock being visible at the front side of cas-

ing, A, as clearly shown in the drawings. The rotation of driving member, M, by the time train imparts a steady uniform movement to the slidable carriage having members, G, G', of the card guide or holder. 5 The operation of the time train upon driving member, M, imparts to the carriage having card guide members, G, G', a travel or movement equal at least to the length of a scale, B, C, or E, on the record card during a period equivalent to the full quota of 10 working hours per day; in other words, for a period of eight hours the time train will move members, G, G', a distance equivalent to the length of the individual scales on the record card, assuming that said card is 15 marked for an eight-hour working day.

Obviously the time train should not operate the card guide or holder during the noon or lunch hour, or half-hour; as the case may be, and provision should be made for returning the card guide or holder from an advanced position at the completion of the hours of a working day and prior to the commencement of another working day. 25 For precluding movement of the card guide or holder during noon or luncheon period, or, in other words, to permit the card guide or holder to remain at rest during such time, it is preferred to interrupt the teeth of the driving member, M, and, as shown in Fig. 3, driving member, M, is mutilated by cutting out certain of the teeth, thus leaving a gap or space, *m*. When driving member, 30 M, is rotated by a time train, its mutilated section, *m*, will be opposite to the teeth of rack, I, upon the arrival of the noon hour or luncheon period, but as the luncheon period expires, other teeth of the driving member, M, will be automatically brought into engagement with the teeth of the rack, I, thus resuming the operation of propelling the rack and card guide, it being manifest 40 that the rack and card guide will be at rest when the mutilated part, *m*, is brought opposite to the tooth portion of rack, I. When the time train turns member, M, for a distance required to move the card guide or holder the length of the card, it is desirable 45 to preclude any further movement of said card guide or holder, such operations taking place at the end of the working day. For securing these results, driving gear, M, is provided with another mutilated portion, 50 *m'*, adapted to permit rack, I, to stop at the end of the day and thus arrest the continual travel of the card guide or holder.

The machine is equipped with means for automatically returning the card guide or holder from the advanced position which it occupies at the completion of a working 60 day and prior to the beginning of another working day. Such mechanism is shown in Figs. 4, 5 and 6 of the drawings, and may be described as follows: A vertical spindle,

O, depends from a hanger, *o*, supported on the top, *f*, of the casing. Around this spindle is coiled a spring, P, which is incased within a drum, Q, one end of the spring being fastened to the spindle and the other 70 end attached to the drum, see Fig. 6. The drum is free to rotate upon the spindle, and it is provided with a gear, *q*, and a ratchet, *q'*. The drum is positioned for its gear, *q*, to mesh with the teeth of the rack, J, the latter being secured to cross-heads, *h*, *h'*, *h*², as shown in Figs. 4 and 5. With the ratchet, 75 *q'*, of the drum engages the nose, *r*, of a pawl, R, the latter being similar in form to a bell crank, as shown in Fig. 6. The pawl is pivoted at its knee by a pin, *s*, to a supporting member, S, fixedly secured to the lower end of spindle, O, and with said pawl engages a spring, S', which is secured at one end to a stud, *s'*, on the supporting member, S. 80 The heel of the pawl is shown as having a beveled face, *r'*, which is positioned in the path of a trip, R', secured to driving gear, M, at a point opposite to gap or space, *m'*, of said gear, whereby the trip is adapted to operate on the beveled heel of the pawl for the purpose of turning said pawl against the tension of spring, S', and disengaging the nose of said pawl from ratchet, *q'*, of spring-actuated drum, Q. 85 90 95

It will be understood that the time train operates member, M, to impart traveling movement to the carriage having members, G, G', of the card guide; rack, J, partakes of this traveling movement of said carriage. 100 The movement of the rack rotates drum, Q, for the reason that said rack meshes with gear, *q*, and the spring, P, is thus placed under tension; the spring being precluded from unwinding when the carriage comes to a rest during the luncheon or noon-hour by the engagement of pawl, R, with ratchet, *q'*. By the operation described the spring is placed under sufficient tension to return the carriage of the card guide or holder to a normal position at the end of a working 110 day. When the driving member, M, is rotated the required distance by the time train, say within an hour or other predetermined time at the end of a working day, the trip, 115 R', engages with a beveled heel of the pawl and said pawl is turned against the tension of spring, S', to a position wherein its nose is free from the ratchet of the drum. Spring, P, is now free from the restraint 120 of the pawl and ratchet, and said spring acts to rotate drum, Q, and gear, *q*, in a reverse direction, whereby the gear acts on the rack, J, for the purpose of returning the carriage and members of the card guide to their first 125 positions.

For the purpose of assisting the workman in positioning the record card within the machine, as well as for precluding any manipulation of the card at or during its 130

insertion in the machine, I employ two retaining members, T, T'. Said retaining members consist of rails positioned upon the top, *f*, adjacent to slot, *g*, therein. One rail, T, is secured directly to the top by suitable means, such as the screw, *t*. Said rail extends beneath the overhanging part of the punch mechanism and it is parallel to the slot, *g*. Furthermore, said rail is shown as having angular ends, *t'*, upon which rest the other rail, T'. Said rail, T', is shown in Fig. 4 as being fastened by a screw, *t*² to the overhanging part of stand, K, the end portions of said rail, T', resting upon, or being secured to, the angular ends, *t'*, of the rail, T. The record card should be inserted beneath the rail, T', and positioned for that side edge of the card having the notch, D, to engage with the rail T. Said rail, T, thus operates to arrest the inward movement of the card in one direction when said card is placed between members, G, G', of the card guide. The member, T', lies over an inserted card and it minimizes any tendency of the card to become displaced or manipulated by the hand of the workman when said card is inserted into the machine for a punching or marking operation.

The mode of operation is as follows: It is to be understood that the time train is in operation and that the carriage and members, G, G', of the card guide have been set in motion at the hour fixed for the beginning of the working day, *e. g.*, eight a. m., this setting operation at such predetermined time, after once determined upon, being accomplished automatically by the time train. When a job, or operation thereon, is assigned to a workman, the first thing to be done by him is to indicate on his record card a guide to be utilized when the work is completed for determining the elapsed time spent on the job. He does this by inserting his card, face upward, under rail, T. The triangular stud, *g*², of guide member, G, enters the notch, D, in a corner of the card, said notched corner of the card engaging with one guide, G, while the other end edge of the card engages with the other guide, G'. Furthermore, the end of the card containing the zero of the scales, B, C, is in contact with the guide, G, whereas the end of the card containing the zero end of scale, E, contacts with guide, G'. The workman now operates the punch mechanism by depressing plunger, K', and causing male die, L, to pass through the card and to cooperate with female die, L', thereby cutting a notch or recess, such as 10, in the edge portion of the card at one side thereof; said notch 10, taken in conjunction with the time scale, E, on the back of the card, indicates the time when the employee began work on a particular job. It will be understood that if the position of this card is

immediately reversed in the machine, *i. e.*, before perceptible time has elapsed, by turning the card face downward and with the stud, *g*², of member, G, entering the notch or recess 10, that the end of the card provided with the zeros of the scales, B, C, and E on the face and reverse of said card will come directly under or be in the same vertical plane as the male die, L, so that the notch, D, will be under the punch. It will be apparent, however, that if any time elapses after the card has been positioned, as last described, it will be indicated or registered on the time scales, B, E, on the face and back, respectively, of the card, by operating the punching mechanism at the period of the elapsed time. It is usual to withdraw the card from the machine after the first operation of punching or marking said card has been performed thereon so as to produce the notch or recess 10 in one edge of the card. The operator proceeds to perform the work called for by the card, and may spend one or more hours, or fraction thereof, in the performance of the work. When the work on the job is completed, however, it is the duty of the workman to return to the machine and reinsert the card therein for the second marking or punching operation. This is performed in the following way: The card is reversed, or turned end for end and face for face so that the time scale, E, on the back of the card will be uppermost. The card is reinserted into the machine by introducing it below the rail, T', and having its notched or punched edge to engage the rail T, with this important distinction, however, whereas in the first punching operation the card was placed in position for the notch, D, to receive the stud, *g*², of member, G, when the card is placed in the machine for the second punching operation, after having been reversed as described, the notch or recess 10 will receive the stud, *g*², of member, G. The card having been positioned with the stud, *g*², in engagement with the notch 10 and in cooperative relation to rails, T, T', the workman again operates the punching mechanism so as to produce a second perforation or recess 11, in the same edge of the card which contains the recess, 10. In all cases the second punch or recess, 11, in the form of card being described, is between notch or recess, D, and notch or recess, 10, as clearly shown in Fig. 2^a.

It will be understood that subsequent to the withdrawal of the card from the machine for the first punching or marking operation, the card holder or guide and members, G, G', are moved relative to the punching mechanism by the operation of the time train, and this movement of the card guide takes place at a predetermined rate and irrespective of the card, that is, whether the

card is in the machine or has been removed from the machine and is in possession of the workman. Should the card be placed in the machine for an appreciable length of time it will be found that said card will move with the card guide and members, G, G', in a direction for the value of scales, B, C, to decrease, assuming that the card is placed face uppermost and in the position required for the first marking or punching operation. Manifestly the card cannot be introduced in any other but the proper position between the guides, G, G', for the reason that stud, g^2 , of member, G, must enter the notch, D, in the corner of the card. Any manipulation of the card, after having been placed in position for the first punching operation, cannot be performed by the workman for the reason that the guides, G, G', preclude any movement of the card endwise, rail, T, precludes movement of the card sidewise in one direction, rail, T', precludes movement of the card in an upward direction, and any movement of the card away from rail, T, will remove it from position below the punch.

The foregoing operations may be illustrated by an example, as follows: We will assume that when the card is first placed in the machine face upward, and punched, the recess will occupy the position indicated by 10, in Figs. 1^a and 2^a, and, accordingly, as will be observed from the position of this recess on the time scale, E, on the back of the card, he began work at nine o'clock. Now, as previously stated, if this card is reversed end to end with its face downward, and with the stud, g^2 , of guide, G, in said recess, and again punched after a certain time has elapsed, say at three p. m., said second punch, or recess 11, will be so positioned with reference to scale, B, as to indicate thereon, reading from zero and without any calculation, that five hours have elapsed between the two punches, figuring on the idle noon hour. It will be understood, of course, that in practically working the machine, the employee would not immediately reverse his card, as heretofore described, but having first punched the same he would remove the card from the machine and proceed with his work. Having completed the work he would then reinsert the card in the machine, reversed as described, *i. e.*, face downward with stud, g^2 , of guide member, G, within said recess, and then operate the punch to produce the second recess therein. Elapsed time can then be read on scale, B, in the same manner as described in the specific example above given, and the compensation or wages to which the employee is entitled for such elapsed time is directly indicated and may be read on wage scale, C. It will thus be observed that when the workman hands in

his punched card, his wages and elapsed time appear thereon without the necessity of any calculation whatsoever.

In Figs. 7 and 8 of the drawings I have shown the record card, A, having scales, B, C, E, and notch, D, punched to secure readings differing from the readings afforded by the scales on the card of Figs. 1^a and 2^a. In the example shown in said Figs. 7 and 8, the workman is presumed to have begun his work on the job at 8 a. m. and to have completed the work at 12 m., showing that he has worked four hours on the job and is entitled to receive a compensation of 96 cents. The first step consists in inserting the card, face uppermost, into the machine, in register with guides, G, G', and operating the punch to produce the notch or recess 10^a showing that he began work at 8 a. m. At the completion of the work, *i. e.*, at 12 m., the card was reversed, again inserted, face downward, into the machine, with the recess 10^a in register with stud, g^2 , of member, G, and again punched, thus producing the recess 11^a. By reading the card from the zero ends of scales, B, C, to the second punch 11^a, it will be seen that the workman devoted four hours to the work, and that his compensation amounted to 96¢.

In the machine described, the punch mechanism is stationary, while the card guide or holder is movable relative to the punching mechanism by the operation of the time train; but it is manifest that the parts may be reversed, *i. e.*, by making the card guide or holder stationary and by imparting movement to the punching or other mechanism for marking the card.

As shown, the die, L, of the punching mechanism is beveled so that the recess 10 or 10^a first produced in the card will register with the stud, g^2 , of card guide or member, G, when the card is reversed and reinserted previous to the second punching operation.

By beveling the punch as described, it will be apparent that the bevels of the recess punched on the face of the card will be opposite to that in the recess punched on the back of the card, see Figs. 2^a and 8, thereby affording a means for determining whether or not the card has been reversed end to end in the machine after the first punching, and that it occupied such reversed position at the time of the second punching.

Referring to Fig. 9, this illustrates a form of card which may be used in the machine for the purpose of calculating the premium due an employee for accomplishing a given amount of work in less than a specified period; *i. e.*, for expediting the work, known technically as a "premium plan" or "differential piece work". This card is the same as that heretofore described with the exception that the face thereof is provided with an additional time scale, B', and, also, with

an additional rate scale, C'. The figures on these scales, however, run in the reverse direction from those on the other time and rate scales, and may be positioned at any desired place on the card, though preferably in parallel relation to and adjoining said other scales. An illustration of the manner of using this card for the purpose specified will be given. Let it be assumed that a workman has been assigned a job on which the employer has set a time limit of four hours and fifteen minutes; *i. e.*, that the workman will be paid his usual rate, say twenty four cents per hour, if the work is accomplished in the time specified, and will be paid at the same rate, also, if he takes additional time to complete the work. However, if he accomplishes the work in less than four hours and fifteen minutes, say in three hours and fifty minutes, he will be entitled to a premium for expediting the work to the extent, under the assumed conditions, of 25 minutes; this premium being at the same rate as his usual wages and amounting, therefore, at the rate of 24 cents per hour, to 10 cents. So far as punching the first recess 10^b, and manipulating the premium card in the machine, are concerned, this is effected in exactly the same way as with the card shown in Figs. 1^a and 7; in other words, the function or operation of the machine is the same on a premium card, as it is on the plain wage card heretofore described. The position of the second recess 11^b, however, indicates, in addition to the elapsed time and wages previously described, the time saved by the employee, and the wage premium to which he is entitled therefor. As shown in Fig. 9, the recess 11^b indicates the elapsed time of 3 hours and 50 minutes on the time scale, B, and the regular wage therefor of 92 cents on rate scale, C. It also indicates on the auxiliary time scale, B', a saving of 25 minutes, *i. e.*, an expediting of the work to the extent of 25 minutes, and on the auxiliary rate scale, C', the premium therefor of 10 cents, making a total of 102 cents for the elapsed time of 3 hours and 50 minutes.

It will be obvious that the mechanism and devices described may be employed for determining various data, such as the cost of operating a telephone for a given period, or the cost of running a machine for a given period, this latter data being of especial value in estimating the depreciation in wear and tear of such machine. It may be used, also, for measuring units of power, time, energy, etc. For whatever purpose used, however, the reading of the time scale, due to the punching and reversing of the record card in the manner heretofore described, is always from the zero mark on said scale, and the same is true in reading the wage scale. Such being the case, that all the units calculable on the machine, such as time, wages,

etc., are readable directly from the record cards.

It will be manifest that the principle of my invention may be embodied in a machine where the record card employed, instead of being of the rectangular shape described, as well as manipulated as described, may be of circular form, and caused to travel with the movable indicator in a circular path; *i. e.*, the card will travel in a circle, instead of longitudinally, in which case the time and rate scales on the record card would be concentric.

Manifestly, any one or two of the scales of the record card may be omitted. Should it be desired to calculate and obtain a record of elapsed time only, scales, C and E, may be omitted, and the card be provided with scale, B, only, the card being punched and manipulated substantially in the manner described. Should it be desired, on the other hand, to obtain a record of the value of the wages, scales, B and E, may be omitted, and the card be provided with scale, C, only, said card being manipulated and punched in the manner hereinbefore described. Furthermore, scale, E, may be omitted altogether, but its employment is advantageous for the reason that the punchings 10, 11, indicate the time when the workman began.

A characteristic and distinguishing feature of my invention consists in employing a card provided with rate and time scales in connection with a card guide or holder and a punch or marking device in such a manner that the card, if allowed to remain in the machine when inserted for the first punching operation, will so manipulate or move the card that the value of the scales will diminish, whereas if the card is permitted to remain in the machine when reversed and inserted for the second punching operation, the card will be so moved or manipulated that the values of the scales will be increased, thus in either instance depriving the workman of the value of his time and compensation and prompting him to attend to the work of punching and removing the card as expeditiously as possible. The advantage of this in connection with the first punching operation will be apparent by an inspection of Figs. 1 and 1^a. When the card is inserted, face uppermost, the guide, G, is moved by the time train toward the punch, and as the value of the scales, B, C, on the card increases from the left hand or zero end thereof, the card is moved by the guide toward the punch, and the longer that it remains unpunched in the machine, the lesser will be the value of the first punch with respect to the scales when the card is reversed, the member, g², of guide, G, positioned in the first punch or recess, and the card punched or recessed a second time to secure the reading. The workman thus has every

inducement to punch the card promptly when first inserted and to remove the punched card after the first operation. The same is true in a general way with reference to the second operation. The card having been punched to produce the first recess, 10 therein, it is after a lapse of time reversed and again inserted in the machine, but at this time, the card is placed for the first recess 10 to receive the stud, g^2 , of member, G, the latter moving toward the punch by the operation of the time train. Now, the card having been reversed end for end, the positions of scales, B, C, are changed, and 15 the recessed part of the card is carried toward the punch and the values of the scales are increasing. The workman should be required, therefore, to punch the card promptly and remove it from the machine.

Obviously, it is not necessary that the scales on the cards be required to pass under the marking or punching device. Furthermore, the markings or punchings at the first and second operations, respectively, are not 25 required to be produced on the same edge of the card. Furthermore, the first and second markings or punchings are not required to be of the same character, for the reason that one operation may mutilate the card 30 and the other operation may mark it with ink. Again, the positions of guides relative to the marking or punching device may be varied, so that the card may be placed against one side of the card guide for one 35 operation and against the opposite side of the same guide for the second operation. Furthermore, the cards may be inserted from one end of the machine for the first punching or marking operation, and from the 40 other end of the machine for the second operation. Furthermore, the guides may be adapted to spring back for allowing the card to enter the machine from the end, in which event the marking or punching device should 45 be so constructed that it cannot be operated when the guide is out of position.

The markings or punchings of the card may be made by recessing, depressing, inking, or cutting off a portion of the card, or 50 by affixing devices, metallic or otherwise, to the card in cooperative relation to the scale or scales thereon.

Having thus fully described the invention, what I claim as new, and desire to secure by Letters Patent is.

1. In the art of calculating elapsed time, amounts, etc., and making unalterable records, the method which consists in positioning a card, provided with time and rate 60 scales, face upward with reference to a moving guide, then punching or otherwise marking said card so as to produce an index thereon for the purpose of determining the position of said card for a subsequent marking or punching operation, then, at a subse-

quent time, reversing the card end to end or face to face and positioning it with the said index in cooperative relation with the moving guide, and then punching or otherwise marking it with reference to the scales 70 so that the time which elapsed between the two said punching or marking operations is indicated on said time scale and the amount represented by said elapsed time is directly readable on the rate scale.

2. In the art of calculating elapsed time and wages and making unalterable records, the method which consists in positioning a card, provided upon its face with time and rate scales, with reference to a moving guide and punching or otherwise marking said 80 card so as to produce an index thereon for the purpose of determining the position of said card for a subsequent marking or punching operation, then, at a subsequent time, reversing the card and placing it in a position determined by the said index, and punching or otherwise marking the card with reference to the scales so that the time which elapsed between the two said punching or marking operations is indicated on 90 said time scale and the wages represented by said elapsed time is directly readable on the rate scale.

3. In the art of calculating elapsed time, amounts, etc., and making unalterable records, the method which consists in positioning a card, provided upon its face with time and rate scales, face upward with reference to a moving guide, then punching or otherwise marking said card so as to produce an index thereon for the purpose of determining the position of said card for a subsequent marking or punching operation, then, at a subsequent time, reversing said card and placing it in a position wherein the said index is in cooperative relation with a guide the movement of which corresponds to that of the first named guide, and then punching or otherwise marking it with reference 110 to the scales so that the time which elapsed between the two said punching or marking operations is indicated on said time scale and the amount represented by said elapsed time is directly readable on the rate scale.

4. In the art of calculating elapsed time and wages and making unalterable records, the method which consists in positioning a card, provided with time and rate scales and with a permanent index near one end 120 of said scales, so that said permanent index is in cooperative relation with a moving guide, then punching or otherwise marking said card so as to produce a second index thereon for the purpose of determining the position of the card for a subsequent marking or punching operation, then, at a subsequent time, reversing said card and placing it in a position determined by the said second index, and thereafter punching or other- 130

wise marking the card with reference to the scales so that the time which elapsed between the two said punching or marking operations is indicated on said time scale and the wages represented by said elapsed time is directly readable upon the rate scale.

5. In the art of calculating elapsed time, amounts, etc., and making unalterable records, the method which consists in positioning a card, provided with time and rate scales and with a permanent index near one end of said scales, so that its permanent index is in coöperative relation with a moving guide, then punching or otherwise marking said card so as to produce an index thereon for the purpose of determining the position of said card for a subsequent marking or punching operation, then, at a subsequent time, reversing said card and punching or otherwise marking it with reference to the scales, and at a point intermediate the permanent index and the index produced by the first punching or marking operation, so that the time which elapsed between the two said punching or marking operations is indicated on said time scale, and the amount represented by said elapsed time is directly readable on the rate scale.

6. In the art of calculating elapsed time and wages and making unalterable records, the method which consists in placing a card, provided upon its face with time and rate scales and upon its back with a time scale running in an opposite direction to said time scale on the face of the card, in coöperative relation to a moving guide and punching or otherwise marking said card so as to produce an index thereon for the purpose of determining the position of the card for a subsequent marking or punching operation and to indicate on the scale on the back of the card the time of such punching or marking, then, at a subsequent time, reversing said card and placing it in a position determined by the said index, and punching or otherwise marking the card with reference to the several scales so that the time which elapsed between the two said punching or marking operations is indicated on said time scale and the wages represented by said elapsed time is directly readable on the rate scale.

7. In the art of calculating elapsed time, amounts, etc., and making unalterable records, the method which consists in positioning a card, provided upon its face with coöperating time and rate scales, face upward with reference to a guide, then punching or otherwise marking said card so as to produce an index thereon for the purpose of determining the position of said card for a subsequent marking or punching operation, then, at a subsequent time, reversing the card end to end and face to face and positioning it with the said index in co-

operative relation with the guide, and then punching or otherwise marking it with reference to the scales so that the time which elapsed between the two said punching or marking operations is indicated on said time scale and the amount represented by said elapsed time is directly readable on the rate scale.

8. In the art of calculating elapsed time and wages and making unalterable records, the method which consists in positioning a card, provided upon its face with coöperating time and rate scales, with reference to a guide and punching or otherwise marking said card so as to produce an index thereon for the purpose of determining the position of said card for a subsequent marking or punching operation, then, at a subsequent time, placing the card in a position determined by the said index, and punching or otherwise marking the card with reference to the scales so that the time which elapsed between the two said punching or marking operations is indicated on said time scale and the wages represented by said elapsed time is directly readable on the rate scale.

9. In the art of calculating elapsed time and wages, the method which consists in placing a card, provided on its face with a time scale and a rate scale having their basic or zero marks at the same end of the card and having a time scale on the back of the card with its basic or zero mark at the other end of the card from that of the said time scale on the face of the card, in such relation to a movable guide that the end of said card having the zeros on the face thereof is next to said guide, operating the guide at a predetermined speed to feed the card forward, punching a recess in said card for the purpose of forming a guide mark thereon, then, after the elapse of a period of time, reversing the card end for end with its face downward, and with the said recess in substantially the same position with reference to the movable guide as that occupied by the zeros of the scales on the face of the card during the aforesaid punching operation, and then punching a second recess in the card, whereby the said elapsed period of time and the wage compensation therefor may be read directly from the time and wage scales, respectively, on the face of the card, reading from the zero of said scales.

10. In the art of calculating elapsed time and wages, the method which consists in placing a card, provided on its face with a time scale and a rate scale having their basic or zero marks at the same end of the card and having a time scale on the back of the card with its basic or zero mark at the other end of the card from that of the said time scale on the face of the card, in such relation to a movable guide that the end of said card having the zeros on the face thereof

is next to said guide; said card being placed face upward, operating the guide at a predetermined speed to feed the card forward, placing a mark on said card for the purpose of forming a guide, then, after the elapse of a period of time reversing the card end for end with its face downward, and with the said mark in the same position with reference to the movable guide as that occupied by the zeros of the scales on the face of the card during the aforesaid marking operation; and then placing a second mark on the card, whereby the said elapsed period of time and the employee's compensation therefor may be read directly from the time scale and wage scale, respectively, on the face of the card, reading from the zero of said scales.

11. In the art of calculating various units and fractions thereof, the method which consists in placing a card, having a scale of said units on the face thereof and a similar scale on the back of said card with its numerals or indications running in an opposite direction from those of the said scale on the face of the card in such relation to a guide that the zero end of the scale on the face of the card is next to said guide, operating the guide at a certain speed to advance the card, punching a recess in said card, then, after the elapse of a period of time, reversing the card; end for end and with its face downward and with the said recess occupying substantially the same position with reference to the movable guide as that occupied by the zero end of the scale when the card was first punched, and then punching a second recess in the card, whereby the feed of the card, during said elapsed period, and consequently the units on the scale on the face of the card may be read directly from said scale starting from zero.

12. In the art of calculating various units and fractions thereof, the method which consists in placing a card, having a scale of said units on the face thereof and a similar scale on the back of said card with its numerals or indications running in an opposite direction from those of the said scale on the face of the card in such relation to a guide that the zero end of the scale on the face of the card is next to said guide, operating the guide at a certain speed to advance the card, putting a mark on said card while so positioned, then, after the elapse of a period of time, reversing the card, end for end and with its face downward and with the said mark occupying substantially the same position with reference to the movable guide as that occupied by the zero end of the scale when the card was first marked, and then putting a second mark on the card, whereby the feed of the card, during said elapsed period, and consequently the units on the scale on the face of the card may be

read directly from said scale starting from zero.

13. In the art of calculating, the process which consists in manually positioning a card, having time and rate scales, with reference to a moving guide and a punching device so that the movement of the card by such moving guide is toward one end of the time and rate scales, then punching said card for the purpose of producing an index thereon, then, after an elapsed period of time, again manually positioning the card with the said index in cooperative relation with the movable guide whereby the movement of the card by said moving guide is toward the opposite ends of said scales, and then again punching said card with reference to the scales.

14. In the art of calculating elapsed time, the method which consists in positioning a card, provided with a time scale, with reference to a moving guide and punching or otherwise marking said card so as to produce an index thereon for the purpose of determining the position of said card for a subsequent marking or punching operation, then, at a subsequent time, placing the card in a position determined by the said index, and punching or otherwise marking the card with reference to said time scale so that the time which elapsed between the two said marking or punching operations is indicated on said time scale.

15. In the art of calculating elapsed time and wages and making unalterable records, the method which consists in positioning a card, provided with time and rate scales, with reference to a moving member and punching or otherwise marking said card so as to produce an index thereon for the purpose of determining the position of said card for a subsequent marking or punching operation, then, at a subsequent time, reversing the card with reference to a moving member and bringing the said index into cooperative relation with said moving member, and punching or otherwise marking the card with reference to the scales so that the time which elapsed between said punching or marking operations is indicated on the time scale, and the wages represented by said elapsed time is directly readable on the rate scale.

16. In the art of calculating elapsed time, amounts, etc., the method which consists in positioning a suitable card in cooperative relation with a moving guide and a suitable scale, then punching or otherwise marking said card so as to produce an index thereon for the purpose of determining the position of said card for a subsequent marking or punching operation, and then, at a subsequent time, punching or otherwise marking the card at a point intermediate the end of the card and the index produced by the first

punching or marking operation, so that the time which elapsed between the two said punching or marking operations is measured between the second punching operation and the end of the card.

17. In the art of calculating, the method which consists in producing on a card an indicating mark, then, after the lapse of an appreciable interval of time placing the card in a position determined by said indicating mark and producing a second indicating mark on said card, and effecting the calculation by measuring the distance between the end of the card and the second of said indicating marks.

18. In the art of calculating, the method which consists in placing a card in a definite position with reference to a marking device and producing on said card an indicating mark, then, after the lapse of an appreciable interval of time, again placing the card in coöperative relation to the marking device, the position of the card at the second time it is brought into coöperative relation to the marking device being determined by the indicating mark thereon, and then effecting the calculation by measuring the distance between the second indicating mark and the end of the card.

19. In the art of calculating, the method which consists in marking a card, provided with a permanent guide, at one period of time and in a predetermined relation to the permanent guide thereon, then, after the lapse of an appreciable interval of time, again marking the card at a point intermediate the first mark and the permanent guide thereon, and then effecting the calcu-

lation by measuring the distance between the second mark and said permanent guide on the card.

20. In the art of calculating elapsed time and wages, the method which consists in placing a card, provided on one side with a time scale and a rate scale having their basic or zero marks at the same end of the card and having a time scale on the other side of the card with its basic or zero mark at the other end of the card from that of said first mentioned time scale, in such relation to a movable guide that the end of said card having the zeros on the two first mentioned scales is next to said guide, operating the guide at a predetermined speed, punching a recess in said card for the purpose of forming a guide mark thereon, then, after the lapse of a period of time, reversing said card end for end and with the recess in substantially the same position with the movable guide as that occupied by the zeros of the two first mentioned scales on the card during the aforesaid punching operation and then punching a second recess in the card, whereby the said elapsed period of time and the wage compensation therefor may be read directly from the time and wage scales, respectively, on the card, reading from the zero of said scales.

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

CLARENCE A. BISHOP.

Witnesses:

JAS. H. GRIFFIN,
H. I. BERNHARD.