J. W. BRYCE.

ELECTRICALLY CONTROLLED CALCULATING MACHINE.

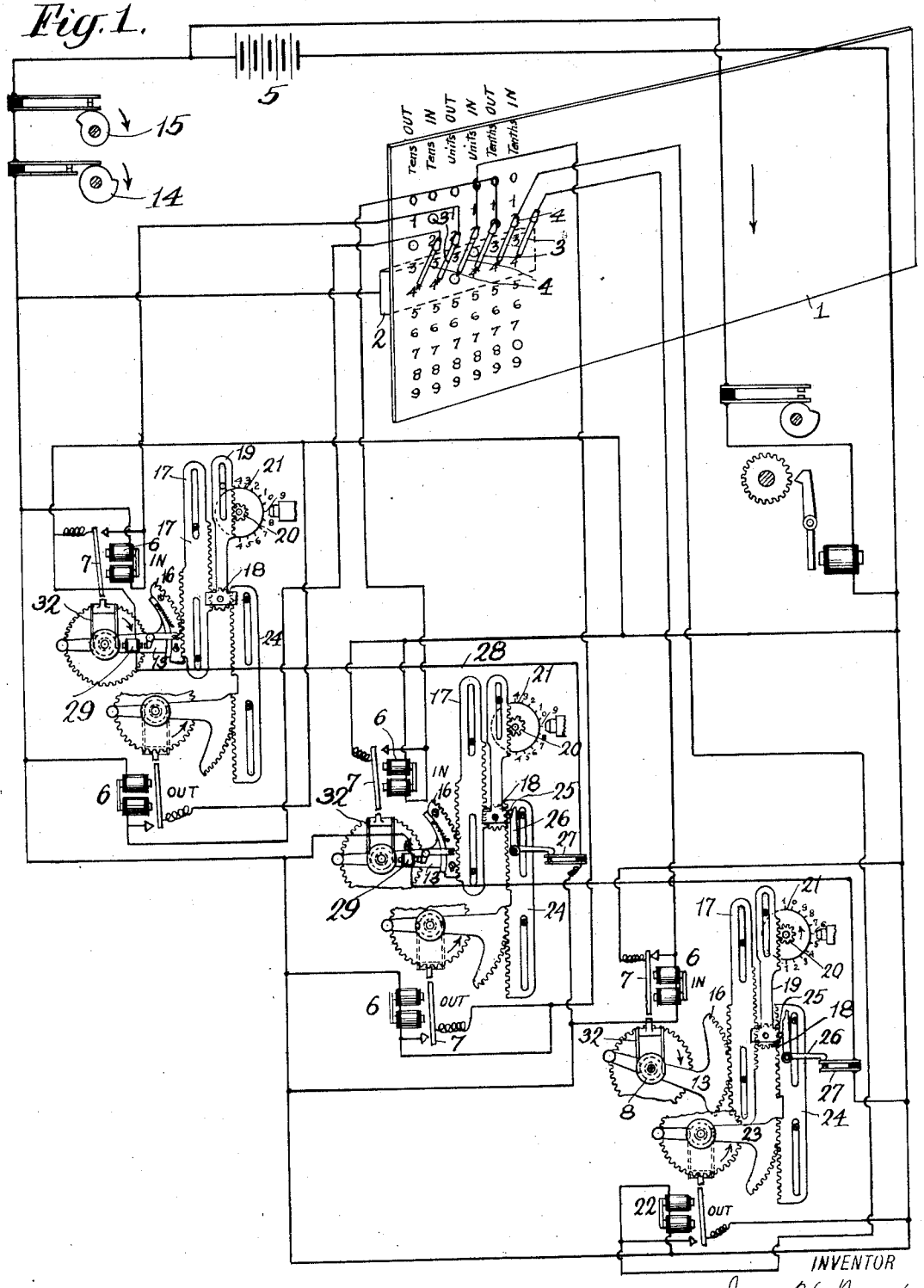
APPLICATION FILED APR. 12, 1916.

1,228,290.

Patented May 29, 1917.

2 SHEETS—SHEET 1.

Fig. 1.



INVENTOR

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2 SHEETS—SHEET 2.

Fig. 2.

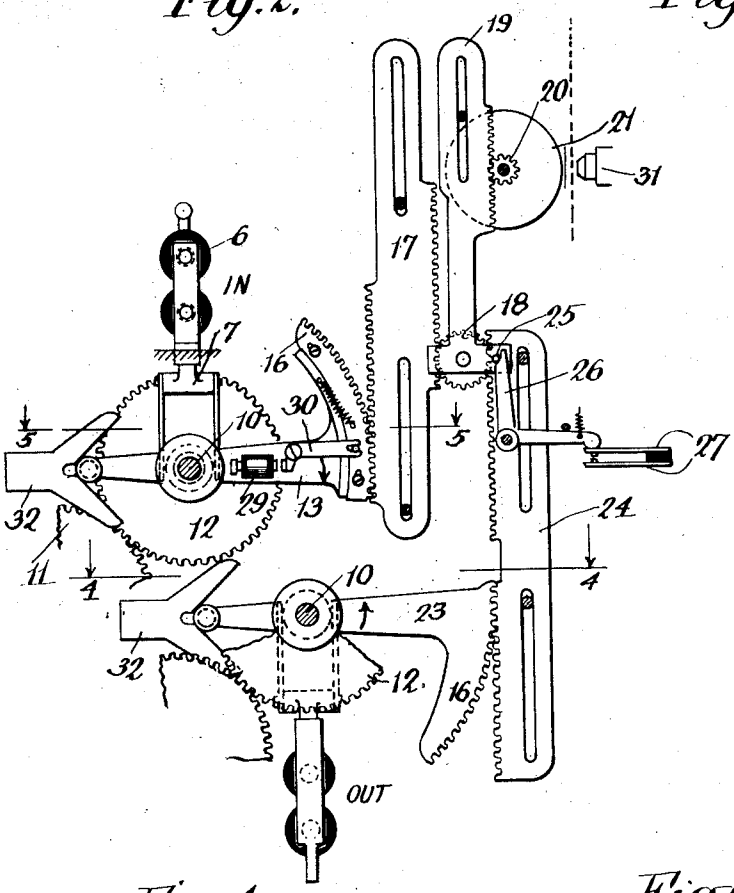


Fig. 3.

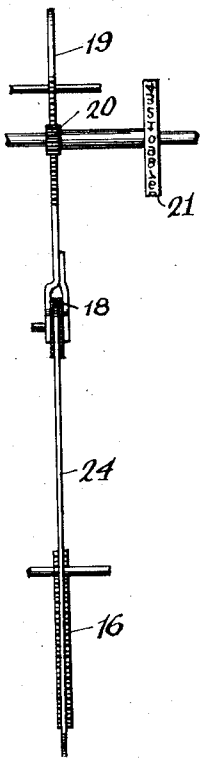


Fig. 4.

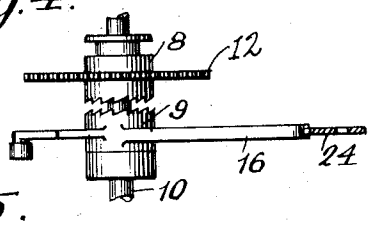


Fig. 5.

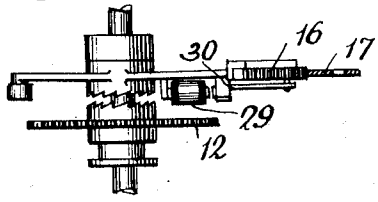
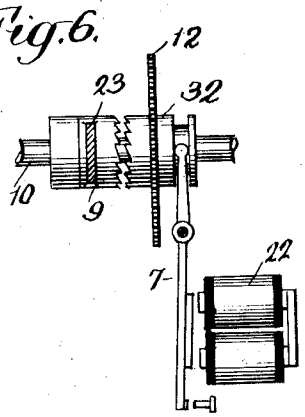


Fig. 6.



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UNITED STATES PATENT OFFICE.

JAMES W. BRYCE, OF BROOKLYN, NEW YORK.

ELECTRICALLY-CONTROLLED CALCULATING-MACHINE.

1,228,290. Specification of Letters Patent. Patented May 29, 1917.

Application filed April 12, 1916. Serial No. 90,568.

To all whom it may concern:

Be it known that I, JAMES W. BRYCE, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Electrically-Controlled Calculating-Machines, of which the following is a full, clear, and exact description.

I have now pending in the United States Patent Office an application for electrically controlled calculating machines, the functions of which are to receive in a suitable chute workmen's punched time cards, showing by the number and location of the punched holes, the "in" and the "out" times of any given piece of work performed by the owners of the cards, and by contact brushes traveling over the lines of such perforations, and closing electric circuits when encountering the holes, to regulate and control the operation of calculating mechanism which determines the elapsed time between the periods indicated by the said "in" and "out" holes and to print or otherwise record the result.

The subject of this application is a machine for the same purpose and operating on substantially the same general lines, but distinguished from the former machine in question by differently designed and operating mechanism for performing certain of the functions necessary in the machine. As this is the case, I shall assume the said prior machine to be, for purposes of this case, a part of the prior art, and confine the description herein very largely to the features of novelty which are here involved, thus avoiding a long description of what may be regarded as already known.

With this object in view I may state that in machine shops, factories and the like, each workman, at the time of beginning a given piece of work inserts into a time recording machine an identifying card which is punched at a certain point or points with holes, the position of which on the card indicates the exact "in" time of the operation. Similarly, on the completion of the job, the card is inserted into the same or a similar machine which punches holes therein indicating by their number and position the "out" or finishing time.

These cards are collected and sent to the office where they are bunched and placed in the receiving container of a calculating machine from which container they are removed, one at a time, and passed through a chute. In passing, the cards are carried under a series of brush contacts which on reaching the perforations therein, set in operation properly constructed devices to adjust time indicating type wheels and other mechanism which calculates the time which has elapsed between the "in" and the "out" perforations and prints or records the result upon a certain portion of the card, after which the latter are passed out of the machine and utilized in well known ways.

Such a machine involves means for passing the cards successively through the chute of the machine, for arresting them at the proper times, and for printing or punching thereon the result of the calculations, and all of such mechanism has been shown and described in my former application above referred to.

It is necessary, moreover, that for each unit of time there should be a type-wheel setting device for both the "in" and for the "out" times, one of which, in the class of machines in contemplation, shall turn the type-wheel in one direction through an arc corresponding to the "in" unit punched, and the other turn it oppositely to an extent determined by the "out" unit punched. There should also be a subtracting device which is operative whenever the "in" unit punched is of greater numerical value than the corresponding "out" unit, to shift the "in" unit type-wheel of the next higher order one division or space, and all of these instrumentalities form parts of my former machine and are fully set forth in the application referred to. In the said former machine I employed in connection with the contact brushes circuit controllers of special and peculiar construction, that which was first operated, when energized, acting to close the circuit to one or the other of the type-wheel adjusting devices, and the other, when energized, serving to throw that operating adjusting mechanism out of action, but in my present form of machine, when a brush contact starts in operation an adjusting device, the latter continues in operation until the main circuit through the machine is broken by a mechanically operated switch.

This difference in function determines the difference in the construction and operation of the two machines, and as these are

mainly based upon structural features they may best be described by reference to the drawings which illustrate my present device.

Figure 1 is a general diagram of the devices used and circuits required for their operation.

Fig. 2 is an illustration, largely diagrammatic in nature, of the special type-wheel adjusting devices employed.

Fig. 3 is a side elevation of the same devices.

Fig. 4 is a detailed view of a clutch mechanism for the "out" sector.

Fig. 5 is a similar view, showing the clutch mechanism for the "in" sector.

Fig. 6 is a view showing the means for throwing the clutch mechanism.

Referring to Fig. 1, and bearing in mind that I shall not enter into an extended description of those parts which have already been fully described in connection with the former machine, the numeral 1, indicates a punched card which is inserted into and carried through the chute of the calculating machine. Back of this card is a contact plate 2, and a series of brush contacts 3, 4, bear upon the card and when a perforation therein passes under a brush the latter completes the circuit of a battery 5 through the appropriate devices.

Let it be assumed that the first hole to be thus encountered is that punched over the figure 8 in the "in" column of the first pair which indicate tenths of units of time. This closes the circuit to the "in" magnet 6, which attracts its armature 7, and thereby throws the clutch 8, into engagement with the member 9, which is rotatably mounted on the constantly rotating shaft 10, the gear 12 integral with the clutch 8, and in gear with the driving gear 11, thus imparts rotation to the member 9, and causes a lever 13 which it carries to revolve about the shaft 10.

The closing of this circuit by the passage of the brush is but momentary, but the magnet 6, when energized closes a second circuit through itself and remains active as long as the main circuit is complete. When any one of the "in" or the "out" magnets therefore is closed and operates to start its corresponding lever 13 or 23, in movement, such lever continues to move until a timed cam 15, breaks the main circuit of the machine. This occurs as soon as the uppermost row of numerals or line for perforations in the card passes beyond the line of contact brushes, and in the same way by means of another timed cam 14 this circuit is closed just before the lowermost line of numerals reaches the line of brushes.

Each lever 13, has a toothed sector 16 at its end which engages with the teeth of a plate or bar 17, guided in any proper manner to slide vertically in obedience to the impelling force of the swinging lever.

On all of the levers 13, except the first in the series this sector 16 is movable circumferentially, but held against movement normally by a spiral spring connection with the lever. This is for the purpose of permitting an independent movement of the sector in borrowing units from the higher values as will be hereinafter explained.

On the opposite edge of the said plate 17, is a line of teeth with which engages a pinion wheel 18, set in a plate or bar 19, also guided to move vertically. This bar or plate 19, has a line of teeth along its edge which engage the pinion wheel 20 on the shaft of a type-wheel 21, which latter is turned in one direction or the other by the up or the down movement of the rack bar 19.

The type wheels 21 have two series of numeral types representing at equal distances apart 0 to 9 running in the same direction, and normally the position of each wheel is such that a zero type is presented at the printing position. Assuming therefore that the "in" brush of the tenths columns is the first to encounter a hole in the card and that this hole corresponds to the numeral 8, the corresponding lever 13 will begin and continue to turn until the break line is reached and the circuit of the magnet 6 interrupted by the cam 15. Consequently, the "in" tenths type-wheel will have been turned eight spaces or divisions in an anti-clockwise direction, by the downward movement of the bar 17, and if there were no other parts to interfere would present at the printing position the numeral 2.

When the card has descended however, until the hole punched at numeral 2 comes under the "out" tenths brush 4, the "out" magnet 22 is energized and this throws the clutch 32, of the lever 23, which carries a sector 16, engaging a rack bar 24 guided to be moved vertically. This rack bar has a line of teeth at its upper end engaging the pinion wheel 18, and the movement of the lever 23 is upward with the result that when an out magnet is energized the rack bar 24 is moved upward and a tendency is imparted to the type-wheel to turn in a clockwise direction. As a result, and assuming for the moment that the rack bar 17 is stationary, the type-wheel is turned forward two spaces or so as to present the numeral 4, at the printing position.

The fact, however, that both rack bars 17 and 24 may be moving at the same time and in opposite directions has no effect upon the operations above described, for in any event the position of the pinion 18, will depend upon the difference in the movement of the two bars whether occurring simultaneously or successively.

Considering therefore any one type-wheel

the "in" and "out" magnets which control its position will be closed at some points during the passage of the card through the machine and the action of the adjusting mechanism will set the type-wheel to expose at the printing position that numeral which is the result of subtracting the "in" from the "out" numeral.

It may well happen in such cases that the subtrahend has the larger numerical value and that its magnet will be energized before the other. In that event it is necessary to borrow one from the units of the next higher order and in order to accomplish this I use the following devices.

When the "in" magnet is energized first the lever 13 is moved before its corresponding lever 23, and plate 19 is therefore moved downward by the pinion wheel 18. A pin 25 is, however, set in the plate 19 and comes into engagement with a bell crank lever 26, pivoted to the then stationary plate 24. This engagement shifts said lever and closes thereby a circuit between contacts 27, which circuit, marked 28 in Fig. 1, contains an electro-magnet 29 on the "in" lever 13 of the next higher order of time units, and the closing of this magnet shifts a lever 30 that moves the sector gear 16 downward a distance that will shift its type-wheel one type-space.

In the example selected for illustration, for instance, we have assumed that the "in" number in the tenths was 8, and the "out" number was 2. This means that the number exposed in the type-wheel for printing will be 4, and that the type-wheel for the next higher order of units will be set to expose not 0, but 1. Assume then that in the two units columns the "out" number punched is 4, and the "in" number 3. Then the "out" lever will be operated first and the plate 24 will be raised, with the result that the lever 26 is simply raised away from the contacts 27 without closing a subtracting circuit. The operation then continues by the units wheel being turned forward four spaces and backward three spaces but as the subtracting magnet has already turned the wheel one space the numeral brought to the printing position will be 0, and not 1.

What occurs in connection with the first and second type-wheels is repeated in cases of the other, as will now be understood, and when the proper numerals are brought to the printing position they are printed by the impact on the card of a printing pad or lever 31. After the printing operation, levers 32 with forked ends are mechanically thrown forward to force the rear ends of levers 13 and 23 into their normal positions.

It has been found that a machine constructed as above described is capable of very accurate and rapid operation; the parts are comparatively few and by no means complex, and it is not liable to become deranged.

What I claim is:—

1. In a calculating machine, the combination with contacts adapted to travel over a workman's punched time card and to close circuits when passing over perforations therein, of means for breaking the operating circuit of the machine when the contacts have passed the last line for perforations, type-wheels carrying type corresponding to time units, and means for shifting said wheels in opposite directions adapted to be started in operation by the contacts and stopped by the interruption of the main circuit, whereby the type brought to the printing position will indicate the difference between the "out" and the "in" units of time.

2. In a calculating machine, the combination with type-wheels with type for indicating different time units, of electro-magnetically controlled means for turning the type-wheels in opposite directions, differential gearing between the same and the type-wheels, of means for starting the said means in operation at periods of time corresponding to the "in" and "out" holes in a workman's punched time card, and means for interrupting the main circuit of the machine after the card has moved to a certain point whereby the type brought to the printing position will represent the difference between the "out" and the "in" units of time as indicated by the position of the holes in the card.

3. In a calculating machine the combination with type-wheels corresponding to different orders of time units, of independent driving means for moving each wheel in opposite directions, electro-magnets for controlling said means, contacts operating in connection with holes in a workman's punched time card for energizing said magnets, differential gearing between the driving means and the type wheels and a circuit controller for the main circuit including the magnets of the driving means adapted to interrupt the said circuit at a predetermined time with respect to the cycles of operation of the machine.

4. In a calculating machine, the combination with type-wheels corresponding to different orders of time units, adjusting rack bars movable in opposite directions for imparting forward and backward motion to the type-wheels, a rack bar gearing with each type-wheel and with the adjusting rack bars by a pinion carried by it, electro-magnets controlling the operation of the adjusting rack bars, contacts operating at periods determined by the position of punched holes in a workman's time card

to energize said magnets and a timed circuit controller for the main circuit including said magnets.

5. In a time calculating machine controlled in its operation by currents produced by the relative movement of contacts and time cards punched with lines of holes which by their position indicate different points of time, the combination with electro-magnetic type-wheel adjusting mechanism of circuits controlled by said contacts whereby the adjusting mechanism is started in operation at periods of time determined by the position of holes in the card, and a timed circuit controller for throwing the adjusting means out of operation at a predetermined time with respect to the cycles of operation of the machine.

In testimony whereof I affix my signature.

JAMES W. BRYCE.