

Dec. 5, 1939.

A. W. MILLS

2,181,999

PRINTING MECHANISM

Filed June 12, 1936

5 Sheets-Sheet 1

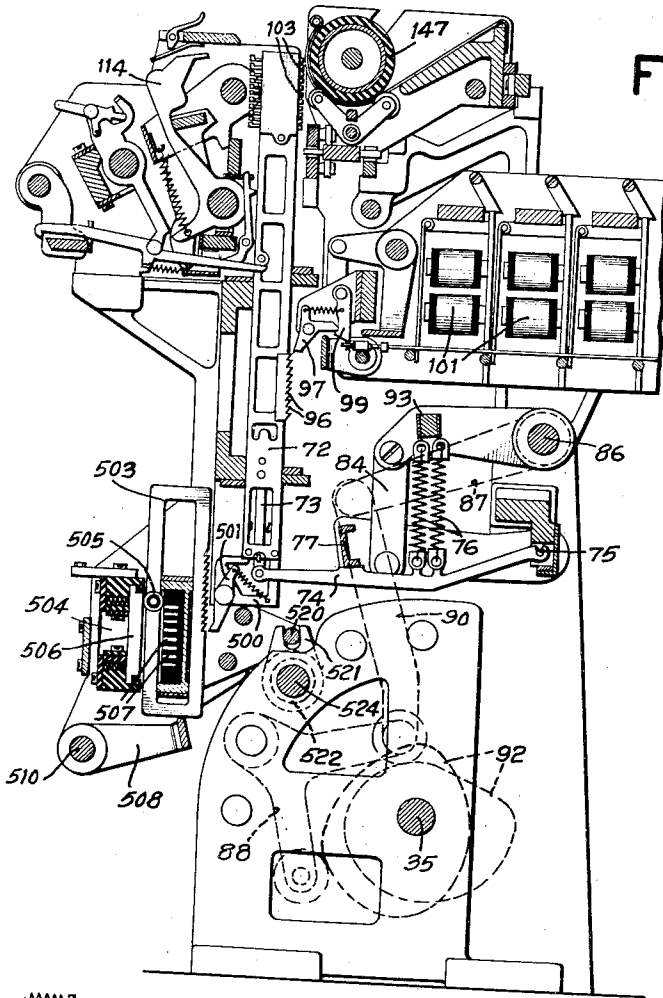


FIG. 1.

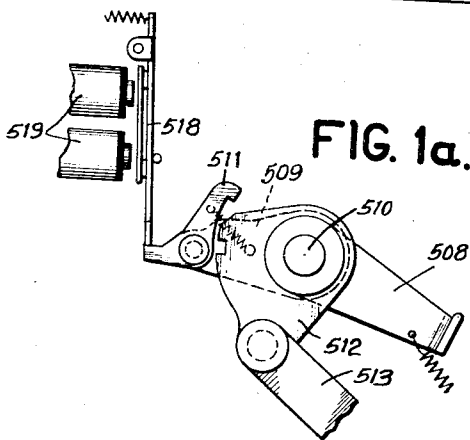


FIG. 1a.

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FIG. 2.

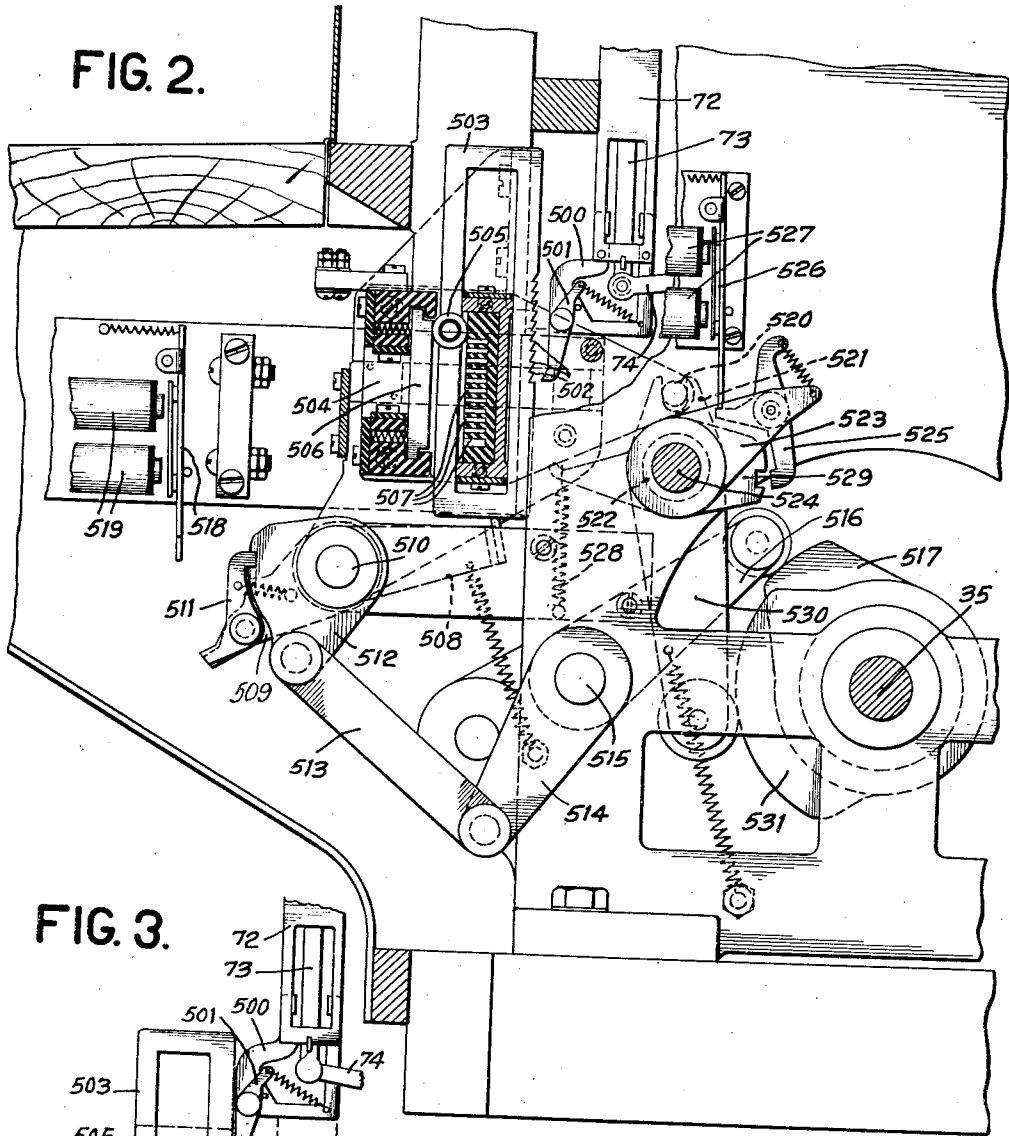
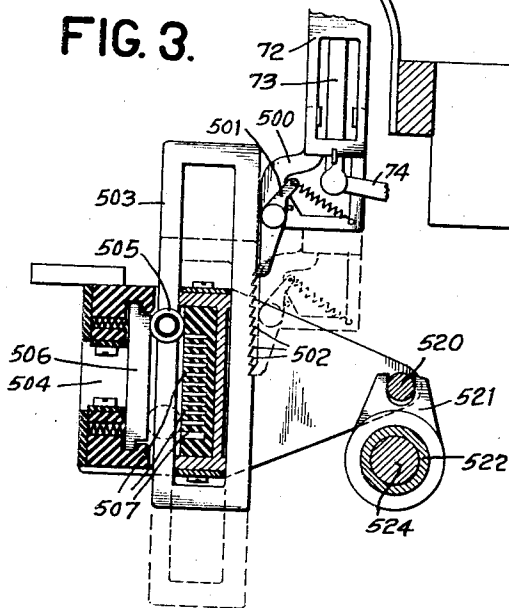


FIG. 3.



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FIG. 4.

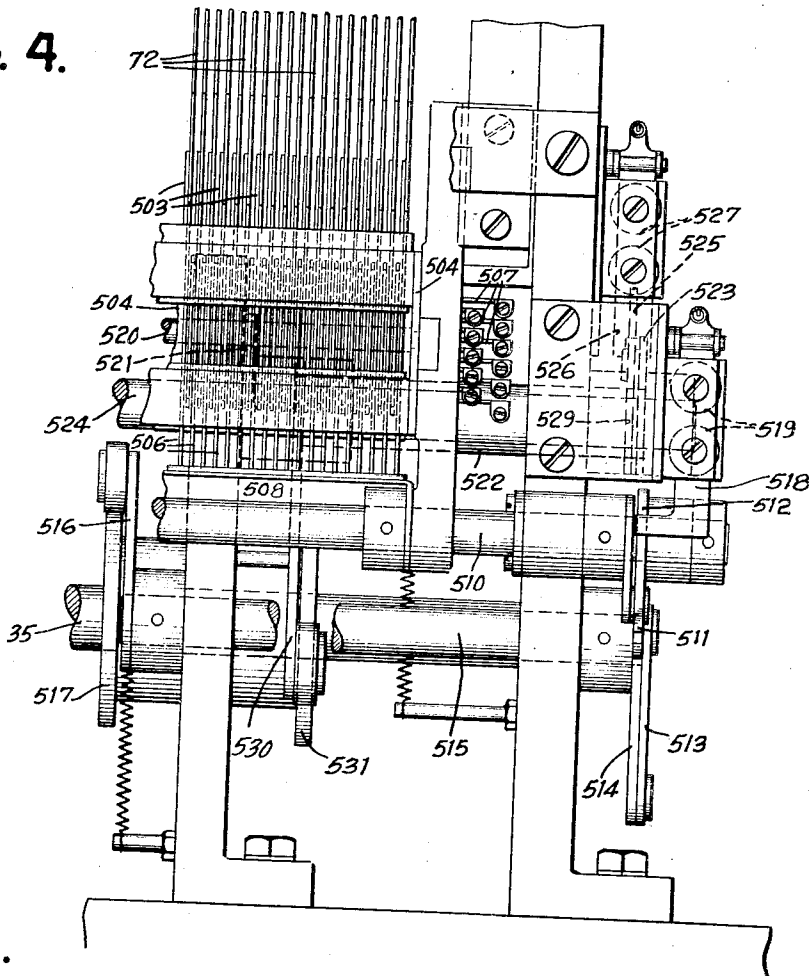
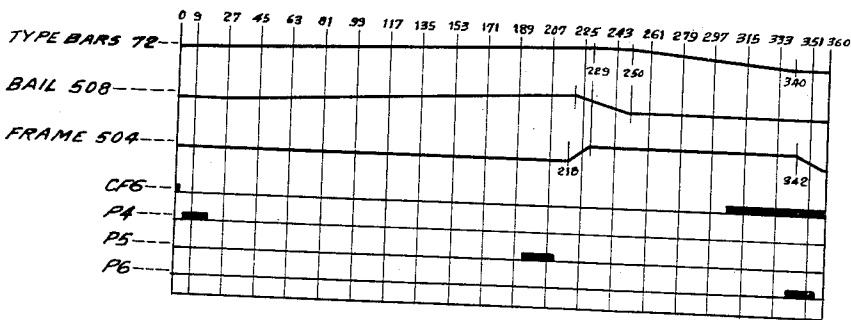


FIG. 5.



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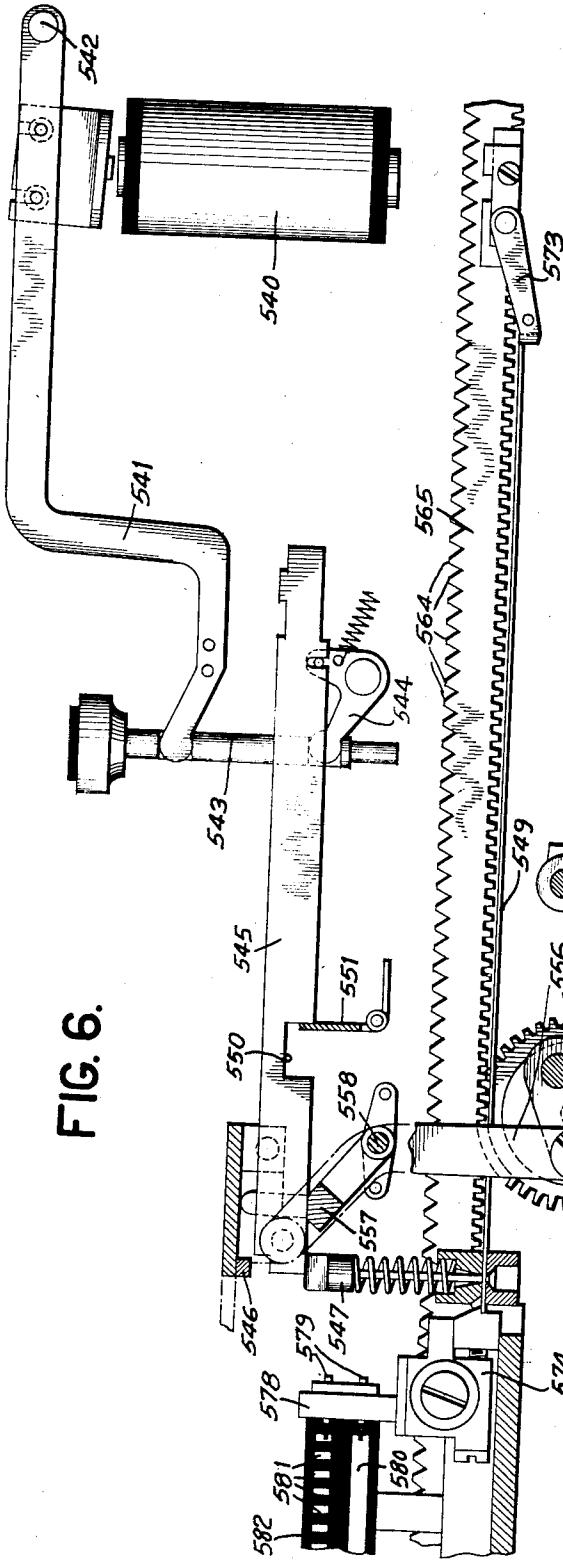


FIG. 6.

FIG. 8.

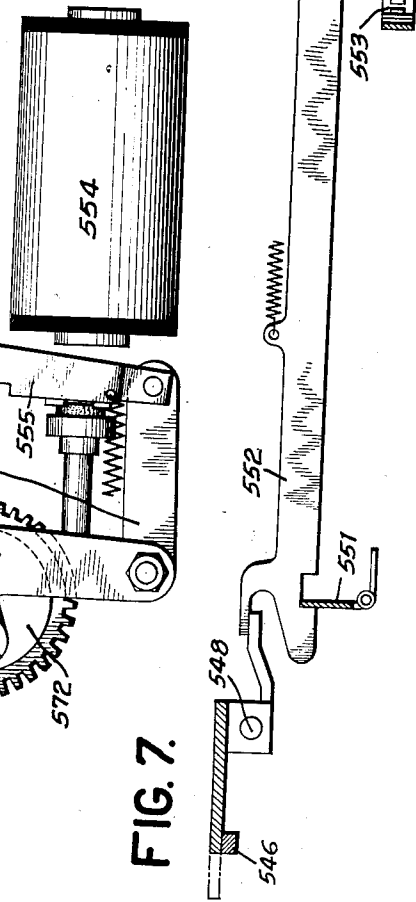
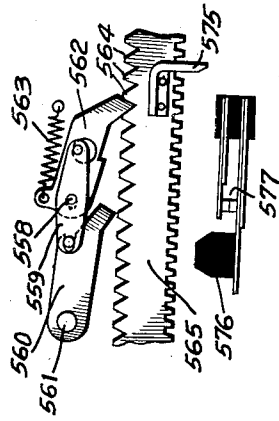


FIG. 7.

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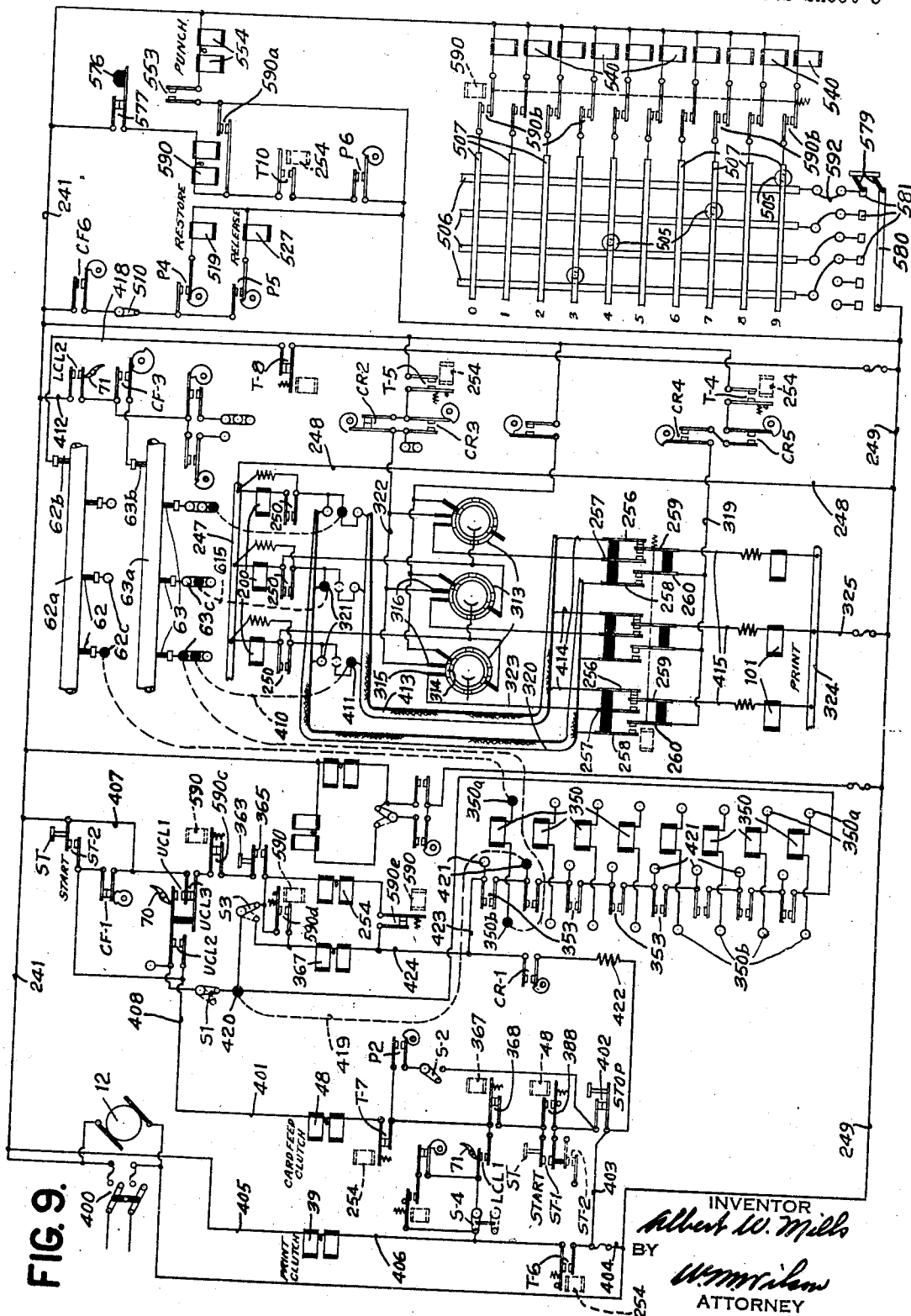


FIG. 9.

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2,181,999

PRINTING MECHANISM

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Application June 12, 1936, Serial No. 84,783

3 Claims. (Cl. 235—61.10)

This invention relates to record controlled accounting machines and more particularly to machines of this type provided with mechanism for automatically punching totals in a record card.

One of the objects of the invention is to provide an improved summary card punching control mechanism for automatically punching totals.

Another object is to provide improved mechanism for punching totals during the normal operation of the accounting machine and without interrupting such operation.

A further object resides in the provision of a setup device controlled by the type carriers of the accounting machine to receive the total printed by the carriers and mechanism to punch said total under control of the setup device.

A still further object resides in the provision of improved mechanism which permits the association of a step-by-step type of punching mechanism with a total printing mechanism of the type wherein the digits of the total are concurrently printed.

A further object resides in the provision of mechanism for delaying the further operation of the accounting machine if the total punching is not completed before the subsequent total printing operation of the accounting machine.

Heretofore, in combinations of accounting and punching machines, upon the impendance of a total printing operation, the accounting machine came to rest during which period the punching machine operated to punch a total card and the accounting machine thereafter resumed operation to print the total and receive data from further record cards. This entailed a delay in the complete operation of the system and required the sum of the time taken by the accounting machine to tabulate and print the total of a group of cards plus the time to punch the total, digit by digit.

With the present arrangement, the punching operation overlaps the total printing and tabulating time so that the total time required is no greater than that of the accounting machine itself. Provision is made so that if the total punched contains a great many digits and the group of cards tabulated is small so that tabulation is completed before the previous total has been punched, the accounting machine will cease operation until the punching has been completed.

Various other objects and advantages of the invention will be obvious from the following particular description of one form of mechanism embodying the invention or from an inspection

of the accompanying drawings; and the invention also constitutes certain new and useful features of construction and combination of parts hereinafter set forth and claimed:

In the drawings:

Fig. 1 is a cross section of the printing mechanism of a tabulating machine showing the set-up device which is controlled by the type carriers.

Fig. 1a is a detail of a clutch device.

Fig. 2 is a detail at an enlarged scale of the set-up device.

Fig. 3 is a detail of the set-up device in another position.

Fig. 4 is an end view of the set-up device.

Fig. 5 is a timing diagram of certain of the cams and electrical devices required to carry out the invention.

Fig. 6 is a cross section of the essential operating mechanism of the punch.

Fig. 7 is a detail of the punch magnet operating contact mechanism.

Fig. 8 is a detail of the punch carriage escape-ment mechanism.

Fig. 9 is a wiring diagram of the electric circuits of the arrangement.

The tabulating machine, which will first be described, is the same as that shown in the patent to J. R. Peirce No. 2,042,324, granted May 26, 1936 and the description thereof will accordingly be limited to the features essential to an understanding of the present invention.

The general operation will be explained with reference to the wiring diagram (Fig. 9) and the reference characters employed will be those of the patent so that ready reference thereto may be had.

To start the machine, the main switch 400 will be closed to supply current to the motor 12 to start the main drive shaft of the machine and other constantly running shafts upon which the contact controlling cams prefixed CR are mounted.

Presuming several groups of cards to be in the machine, the feeding of the cards one by one and the sensing of the data contained thereon may be started by depression of the start key ST to close contacts ST1 and ST2. This sets up a circuit from line 241, contacts ST2, card feed clutch magnet 48, contacts T7, 368 and ST1, stop key contacts 402 to wires 403, 404 to the other side of line 249. Contacts 388 which are operated by magnet 48, close to short circuit contacts ST1 as long as magnet 48 remains energized. The energization of the card feed clutch magnet 48 releases the card feed clutch for operation and

the feeding of the cards commences immediately.

As the cards advance to pass the analyzing brushes 62 and 63 in succession, the usual card levers 70 and 71 are engaged to shift their related contacts. If it is desired to print the items sensed by the brushes, switch S4 is closed, as shown, so that after closure of start key contacts ST1 and LCL1, a circuit will be established from line 231, through wire 405 to print clutch magnet 39, thence through wire 406, switch S4, contacts LCL1, 368, 388, and 402 to wires 403, 404 and line 249.

The closing of contacts UCL1 and UCL2 sets up a circuit from line 241, wire 407, contacts UCL1, UCL2, wire 408, wire 401, to magnet 48 and thence, through the circuit previously traced, to line 249. Cam contacts CF1 are provided to maintain this circuit during the interval between cards when contacts UCL2 and UCL1 are open.

Listing circuit.—If it is desired to effect listing of the data contained in a specific column on the card, the plug socket 63c associated with that particular column will be connected by means of a plug wire 410 to a socket 411. Upon sensing a perforation, the following circuit will be completed: from line 241, wire 412, contacts LCL2, CF3, brush 63b, contact roller 63a, brush 63, socket 63c, plug wire 410, plug 411, cable 413, to a wire 414 corresponding to the selected column, wire 415, print magnet 101, bus bar 324, wire 325 to line 249. The type carrier will thereupon be interrupted with the type element corresponding to the location of the perforation sensed, in printing position.

Adding circuit.—If it is desired to effect adding of the amount, a plug wire 615 is connected as shown so that a circuit traced as follows is completed when a hole in the card arrives at the brushes 63. From line 241, to contacts LCL2, contacts CF3, brush 63b, roll 63a, brush 63, plug 63c, wire 615, plug 321, contact 250, adding magnet 200, bus bar 247, wire 248, to line 249.

Group control.—In this art the cards are usually grouped according to transactions or commodities or salesman. In such case the cards of each group are given a special designation which usually takes the form of a number registered in certain columns of the cards. This number is utilized to control the stopping or other operations of the machine so that when the last card of a group passes through the machine the machine may be caused to stop or to take a total of the group. A representative group controlling circuit for a single column may be traced as follows: from line 241 to wire 412, contacts LCL2, CF3, brush 63b, contact roller 63a, brush 63, plug 63c, plug connection to socket 350b, group control magnet 350, socket 350a, plug connection to socket 62c, brush 62, contact roll 62a, brush 62b, wire 418, contacts T—8 to line 249. Energization of magnet 350 closes its contacts 353 and since control by but a single column is assumed, a plug connection 419 is used to bridge plug socket 420 and plug socket 421 and switch S1 is closed. If it is desired to have the machine stop upon detecting a group number change, switch S3 is shifted to its dotted line position and a circuit becomes established as follows: from line 249, wires 404, 403, resistance 422, cam contacts CR1 which close for a short interval, wire 423, uppermost contacts 353, socket 421, wire 419, plug socket 420, switch S1, contacts UCL1, wire 407 to line 241. This circuit shunts around magnet 367 which is of greater resistance.

If the compared cards fail to agree and con-

tacts 353 consequently remain open, the full flow of current will pass from contacts CR1 through wire 424, magnet 367, switch S3 to plug socket 420 and thence to line 241 as before. Energization of magnet 367 opens its contact 368 thus breaking the circuits through the clutch magnets 39 and 48 to stop the machine.

It is now necessary to operate total key 363 to close contacts 365. This establishes a circuit from line 241, wire 407, contacts UCL3 (now closed), magnet 254, wire 424, contacts CR1, resistance 422, wires 403, 404, to line 249. Energization of magnet 254, as usual, causes the machine to initiate a total taking cycle of operations to print the total standing in the accumulators. Closure of contacts T6 by magnet 254 causes energization of print clutch magnet 39 so that the printing mechanisms may operate in synchronism with the accumulator elements.

If it is desired to have the machine enter upon a total taking cycle automatically upon a group number change, switch S3 is set in its full line position and the control circuit will then branch through magnet 254 instead of magnet 367.

A pair of contacts T7 under control of magnet 254 is held open during the total taking operation to insure inaction of the card feeding devices.

Restarting circuit.—If it be desired to automatically resume card feeding and accumulating of the following group of cards, switch S2 is closed so that as the total printing cycle nears completion, closure of cam contacts P2 will complete a circuit from line 249, wires 404, 403, contacts 402, switch S2, contacts P2, T7, card feed clutch magnet 48, wire 401, wire 408, contacts CF1, wire 407 to line 241.

Total printing circuit.—When a total is to be taken magnet 254 is energized as explained and various contacts are shifted as a consequence. Such contacts are indicated in Fig. 9 by having magnet 254 dotted adjacent thereto. During the cycle following energization of magnet 254, cam contacts CR4, CR5 operate to transmit an impulse through the total taking circuit at an instant corresponding substantially to one point in advance of the "9" index point position on a card. With contact blades 256, 257, 258, 259 and 260 shifted from the position shown so that contacts 258, 260 and 257, 259 are closed and contacts 256, 259 are open, contacts CR4, CR5 complete a circuit from line 241, contacts T4 (now closed), contacts CR4, CR5, line 319, contacts 260, 258, cable 320, plug sockets 321, contacts 250, adding magnets 200, bus 247 to line 249 through wire 248.

This energization of magnets 200 engages all the accumulators for a cycle of rotation which were not already standing at zero position. During the rotation of the accumulator wheels the type bars rise in synchronism with the movement of the register wheels and the attached commutators 313. The motion of each type bar is arrested by an impulse through its printer magnet 101, through a circuit traceable from line 241, contacts T5 (now closed), cam contacts CR2, CR3, wire 322, brush 316, commutator insert 314, brush 315, wire 323, contacts 257, 259 to printer magnet 101, bar 324, wire 325 to line 249. Thus, the counter wheels, when their segments 314 are or arrive at zero position send an impulse to interrupt the associated type bar with the type element corresponding to the value standing on the accumulator wheel, in printing position.

Printing mechanism.—The printing mecha-

nism is shown in Fig. 1 wherein is illustrated the usual type bar 72 having type elements 103 and mounted for vertical reciprocation in the frame of the machine. The reciprocation is brought about by cams 92 carried by the shaft 35 which rotates when print clutch magnet 39 is energized. The cams oscillate follower 88 which through link 90 and arm 87 rocks shaft 86 upon which is fixed bail 93. This bail has link connection 84 to a bail 77 and spring connection 76 to arms 74 pivoted at 75 and connected at their opposite ends to links 73 pivoted to the type bars. Through this mechanism the springs 76 elevate the type bars to successively present type elements 103 to the platen 147 as the corresponding index positions on the cards pass the sensing brushes. Printing magnet 101 upon energization as explained, will attract its armature to rock a latch 99 and release a pawl 97 for engagement with ratchet teeth 96 carried by the type bar to intercept the same.

After all the type bars have been thus positioned the usual printing hammers 114 are tripped to take an impression from the type elements at the printing line.

The above generally describes the operation of the tabulator mechanism necessary to an understanding of the operation of the present invention. For further details of construction, reference may be had to the Peirce patent referred to hereinabove.

Set-up device.—For the purposes of the present invention, each type bar 72 is provided with an extension 500 at its lower extremity (Figs. 1, 2, and 3) upon which is pivoted a spring-pressed pawl 501. Each pawl 501 cooperates with teeth 502 in a frame 503 which is mounted for vertical movement in a frame 504 which in turn is mounted for horizontal movement in the frame of the machine. Frame 503 carries a contact roller 505 insulated therefrom which rides between a spring-pressed vertical bar 506 and a plurality of transverse conducting bars 507. The frictional engagement caused by pressure of bar 506 against roller 505 serves to hold the roller and its frame 503 in any position to which it may have been set.

The action of the parts is such that while the type bars 72 are rising to take position during a total taking cycle of operations frames 503 are reset to their uppermost positions as shown in Fig. 2. The means for effecting this comprises a bail 508 which is mounted on a shaft 510. Also secured to the shaft is an arm 509 to which is pivoted a dog 511 which is adapted to engage a notched member 512 freely mounted on shaft 510 and connected by a link 513 to an arm 514 secured to a shaft 515 which has a follower arm 516 whose roller rides on a cam 517 on shaft 35. In the normal position of the parts dog 511 is disengaged from member 512 as shown in Fig. 1a with the tail of the dog abutting armature 518 of magnet 519. Member 512 is oscillated each cycle of print shaft 35 without effect, but at the beginning of the total taking cycle, as will be explained, magnet 519 is energized to release dog for engagement with member 512 and bail 508 will restore the frames 503. On the return stroke, dog 511 will be intercepted by armature 518 and the parts again disengaged.

Following the restoration of the frames 503 the supporting frame 504 is moved toward the right from the position of Fig. 2 to that of Fig. 3. This is effected as follows: Frame 504 carries a rod 520 (Fig. 2) engaged by a slotted arm 521

which is secured through a sleeve 522 to an arm 523. The arms and sleeve are loose on shaft 524. Arm 523 carries a spring-pressed dog 525 which normally has its tail in engagement with armature 526 of a magnet 527 so that spring 528 connected to an extension of arm 521 holds the parts in the position of Fig. 2. Upon energization of magnet 527, dog 525 engages in a notch in member 529 secured to shaft 524 which through arm 530 is rocked by cam 531 on shaft 35. This engagement takes place after the type bars have risen and frame 504 is shifted to the right so that teeth 502 may be engaged by pawl 501 of the type bar before the bars are restored downwardly. The tooth 502 engaged by any pawl 501 will depend, of course, upon the height to which the pawl has been raised and during the restoration of the type bars the frame 503 is lowered the distance that the bar initially rose. That is, if the bar 72 rose to present a "9" to the printing position, traversing nine steps as shown in Fig. 3, frame 503 will be lowered nine steps as indicated in dotted outline. After the bars have fully descended, frame 504 is retracted, with the frames 503 in displaced position where they remain until the beginning of the next total taking cycle. The relative positioning of rollers 505 and transverse bars 507 serves as a convenient means for controlling punching operations as will be set forth hereinafter.

The magnets 519 and 527 are shown in Fig. 9 and are energized upon closure of cam contacts P4 and P5 respectively. The timing of these contacts is shown in Fig. 5 where it will be observed that contacts CF6 are open during the period of closure of contacts P4 and P5 so that no circuits can be completed therethrough during card feeding operations. Upon a group change, however, the card feed comes to rest with contacts CF6 in closed position so that, with switch S10 closed, P4 and P5 which operate during the total printing cycle will energize their respective magnets 519 and 527 in succession to first restore the set-up device and then shift it to receive the total printed.

The punching machine which will now be described is generally of the form shown in the Lee and Phillips Patent No. 1,772,186, granted August 5, 1930 and the description thereof will be limited to the features essential to an understanding of the present invention.

Referring to Fig. 6, punch selecting magnets 540 are provided, there being one for each index point position of a column of the record card. Energization of magnet 540 will attract its armature to rock an arm 541 in a counterclockwise direction about its pivot 542, thus moving key 543 downwardly to rock a bell crank 544 which has connection with an interposer 545 suitably mounted for horizontal reciprocation. The forward or left end of the interposer 545 is suitably guided between an operating bar 546 and the upper end of a punch 547.

Forward movement of the interposer will position its widest portion between bar 546 and punch 547 so that subsequent counterclockwise rocking of bar 546 will move the interposer and punch downwardly to perforate the record card 549. A notch 550 in the interposer 545 cooperates with a bar 551 to rock the same in a counterclockwise direction when the interposer is moved toward the left. Rocking of bar 551 in such manner will draw a hook-shaped member 552 (Fig. 7) toward the left to close a pair of contacts 553. As can be seen in the circuit diagram, contacts 553 com-

plete a circuit through the punch magnet 554 causing it to attract its armature 555 and through linkage generally designated 556 draw downwardly on the bar 546 to cause depression of the selected punch 547. Depression of key 543 may, of course, be effected independently of the operation of the magnet 540 for the purpose of manually controlling punching operations.

Disposed beneath the interposers 545 is a bar 557 which is carried by a rod 558 upon one end of which is secured an arm 559 (Fig. 8) for operating the escapement mechanism, this escapement mechanism comprising a pawl 560 pivoted at 561 to the frame of the machine and a stepping pawl 562 loosely pivoted on rod 558 and normally urged by a spring 563 into engagement with the teeth 564 on the upper edge of the carriage rack 565. Rocking of rod 558 in a counterclockwise direction under the action of an interposer 545 will lower pawl 560 into engagement with a tooth 564 to hold the rack 565 in position while punching is being effected. This action, at the same time, raises pawl 562 out of engagement with teeth 564 and, by virtue of the loose connection of pawl 562 upon rod 558, will move slightly toward the right in readiness to intercept the next tooth 564 when the rod 558 is returned to its original position.

The rack 565 is suitably mounted for horizontal movement in the frame of the machine and may be manually moved to the right to the position shown wherein a record card 549 is placed in position with the first column thereof in line with the punches 547. Gear teeth cut on the underside of the rack cooperate with suitable gearing 571 which is connected to the usual spring barrel 572 which tends to move the rack toward the left and which effects such movement under control of the escapement mechanism just described. An arm 573 carried by the rack 565 is provided for cooperation with the card 549 to move it to pass by the punches 547 column by column.

The above briefly describes the mechanism necessary to an understanding of the operation of the punch. For further details of construction reference may be had to the Lee and Phillips patent cited. Further reference may also be made to the patent to Lee and Daly, No. 1,976,618, granted October 9, 1934 which discloses the same type of punching machine provided with automatic card feeding mechanism.

Rack 565 carries an arm 575 (Fig. 8) which when the last card column is in punching position will engage an insulating block 576 and open a pair of contacts 577. The bar 565 is also provided with the usual forward card guide 574 to which, for the purposes of the present invention, is secured an insulating member 578 carrying a pair of electrically connected brushes 579, the lower of which traverses a strip of conducting material 580 and the upper traverses a plurality of contact segments 581. The strip 580 and segments 581 are embedded in a bar 582 of insulating material which is secured to the frame of the machine. The spacing of the segments corresponds to the spacing of the card columns and the relationship of the parts is such that the punches 547 are in position to perforate the first column of the record when the brushes 579 connect the first segment 581 with the strip 580 and positioning of the punches over any other column of the card will be accompanied by bridging of the corresponding segment 581 and the common strip 580 by the brushes 579.

The manner in which the total set up by the type bars is punched will now be explained in connection with the circuit diagram (Fig. 9). It will be recalled that, with the machine conditioned to stop upon a group number change, total taking is initiated by operation of total key 363. This caused energization of magnet 254 and brought about a cycle of operation of the printing mechanism during which the P cams operate. Magnet 254 closes a pair of contacts T10 so that when contacts P6 close near the end of the total taking cycle, at which time the reading of the total printed will have been set on the frames 503, a circuit is completed from line 241, last column contacts 577, a magnet 590, contacts T10, and P6 to line 249. Magnet 590 closes its contacts 590a to set up a holding circuit which is maintained until contacts 577 open.

After the total taking cycle card feeding and accumulating resume as usual while punching takes place. In Fig. 9 the bars 506 and 507 are diagrammatically represented with the rollers 505 set to connect the same to represent, for example, the digits 3479.

Magnet 590 closes a group of contacts 590b upon whose closure punching immediately begins. With brushes 579 standing on, say, the first segment 581 to the right in Fig. 9, a circuit is traceable from line 249, strip 580, brush 579, first segment 581, a plug connection 592, first bar 506, roller 505, the "9" bar 507, contacts 590b, the "9" punch selecting magnet 540 to line 241. As explained, energization of magnet 540 advances the related interposer which causes closure of contacts 553 to energize the punch magnet 554 whereupon the "9" index point position of that column is perforated and the carriage escapes to the next columnar position and the selection and punching is repeated until all the card columns have traversed the punching position and the carriage arrives in last column position where contacts 577 are opened to de-energize magnet 590 so that it will be in readiness to be picked up again during the next succeeding total taking cycle.

Where the number of cards in a group is very small it may happen that tabulation of such group is completed before punching of the total of the preceding group has been completely effected. In such case, when the machine is conditioned to stop upon a group change, the operator simply waits for punching to cease before depressing the total key 363. In order to assure this, a pair of contacts 590c are included in series with total contacts 365 and these contacts open and remain so throughout the punching operation.

To delay the total taking cycle, for the same reason when the machine is conditioned for automatic operation, pairs of contacts 590e and 590d are provided which are open and closed respectively by their controlling magnet 590 during punching. The contacts 590e prevent the automatic energization of magnet 254 and the contacts 590d direct the circuit through magnet 367 which, as has been explained, causes cessation of card feeding and printing. Upon completion of punching when magnet 590 is again deenergized, contacts 590c again close so that magnet 254 may be energized upon the next following closure of cam contacts CRI.

While there has been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification, it will be understood that various omis-

sions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention therefore to be limited only as indicated by the scope of the following claims.

What is claimed is as follows:

1. In an accounting machine having record card feeding means, sensing means, an accumulator controlled by said sensing means to accumulate amounts sensed in successively fed record cards, printing mechanism including one or more type carriers and means for advancing and restoring a carrier, control means to cause a carrier to take a differential setting during its advance, in accordance with the digital position of an accumulator element, group control mechanism operative to interrupt the operation of said card feeding and sensing means, and set said control means to cause printing of said digital position, and means to render said card feeding and sensing means effective again upon termination of said printing operation, in combination with one or more differentially positionable contact members, means for effecting coupling of a member with a carrier after the carrier has been differentially set whereby the member will be moved with the carrier during its restoration to effect a setting of the member in accordance with the setting of the carrier, a series of magnets, one for each position of a contact member, a circuit connection completed by a contact member to energize the magnet related to the position in which the member is set, means for rendering said circuit connection effective after said printing and for main-

taining it while the subsequent feeding and sensing operations take place, and means for restoring said member to zero position.

2. The invention set forth in claim 10 in which the carrier is provided with a pawl differentially advanced with the carrier, the contact member is provided with a series of teeth and said coupling means comprises means for sliding said member transversely to the direction of advance of said carrier to bring said series of teeth into engagement with said pawl whereby upon restoration of the carrier the pawl will move the member therewith through engagement with one of said teeth.

3. A device for taking a reading from a type bar including means for effecting a linear movement of a type bar to advance the same to printing position and restore the same, a guide member mounted for reciprocation in a direction transverse to the direction of movement of the type bar, a frame carried by said guide member and slidable thereon in the same direction of movement as the type bar, means for moving said guide member toward the type bar after the bar has been advanced to printing position to engage the frame therewith whereby said frame will be displaced on the guide member during the restoration of the type bar and in the same direction, a distance equal to the initial advance of the bar, means for moving the guide member and its displaced frame out of engagement with the type bar after the bar has been restored and means for restoring the frame to its initial position on the guide member while the frame and bar are disengaged.

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CERTIFICATE OF CORRECTION.

Patent No. 2,181,999.

December 5, 1939.

ALBERT W. MILLS.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, second column, line 4, claim 2, for the claim reference numeral "10" read 1; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 2nd day of April, A. D. 1940.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.

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(Seal)

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Acting Commissioner of Patents.