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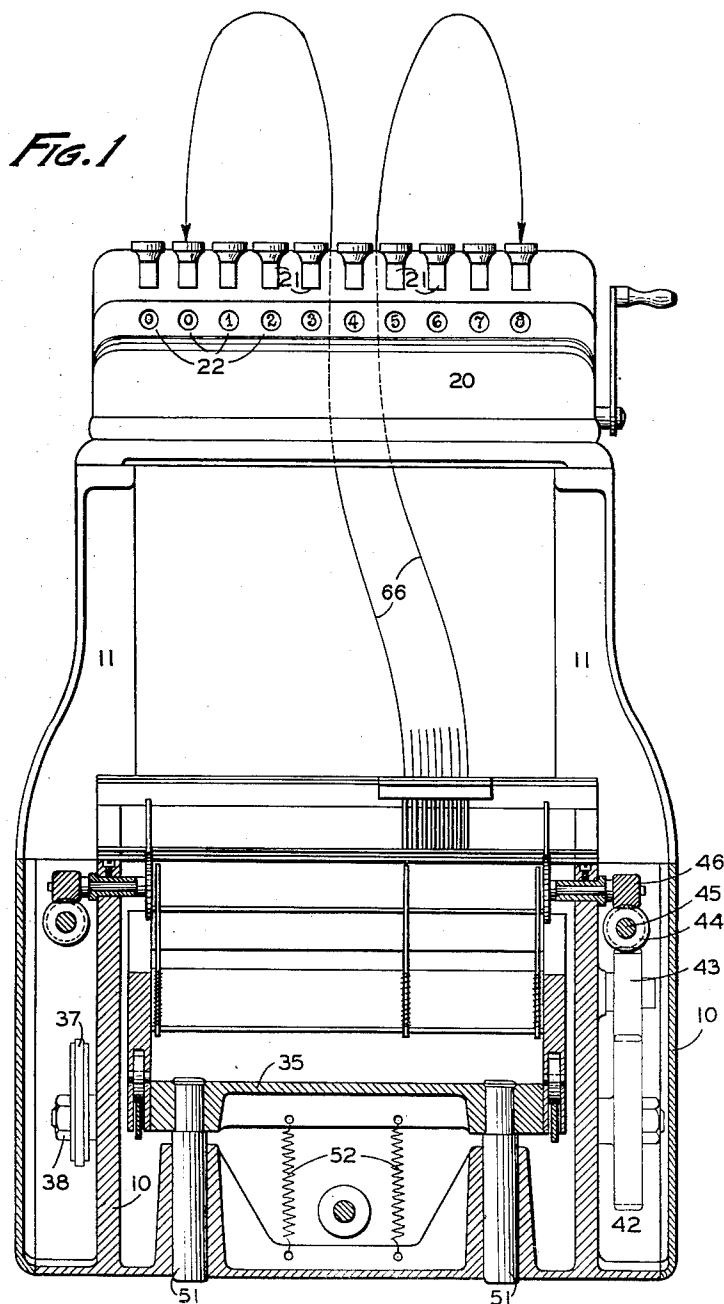
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2,059,277

TABULATING MACHINE

Filed April 2, 1932

6 Sheets-Sheet 1



WITNESS

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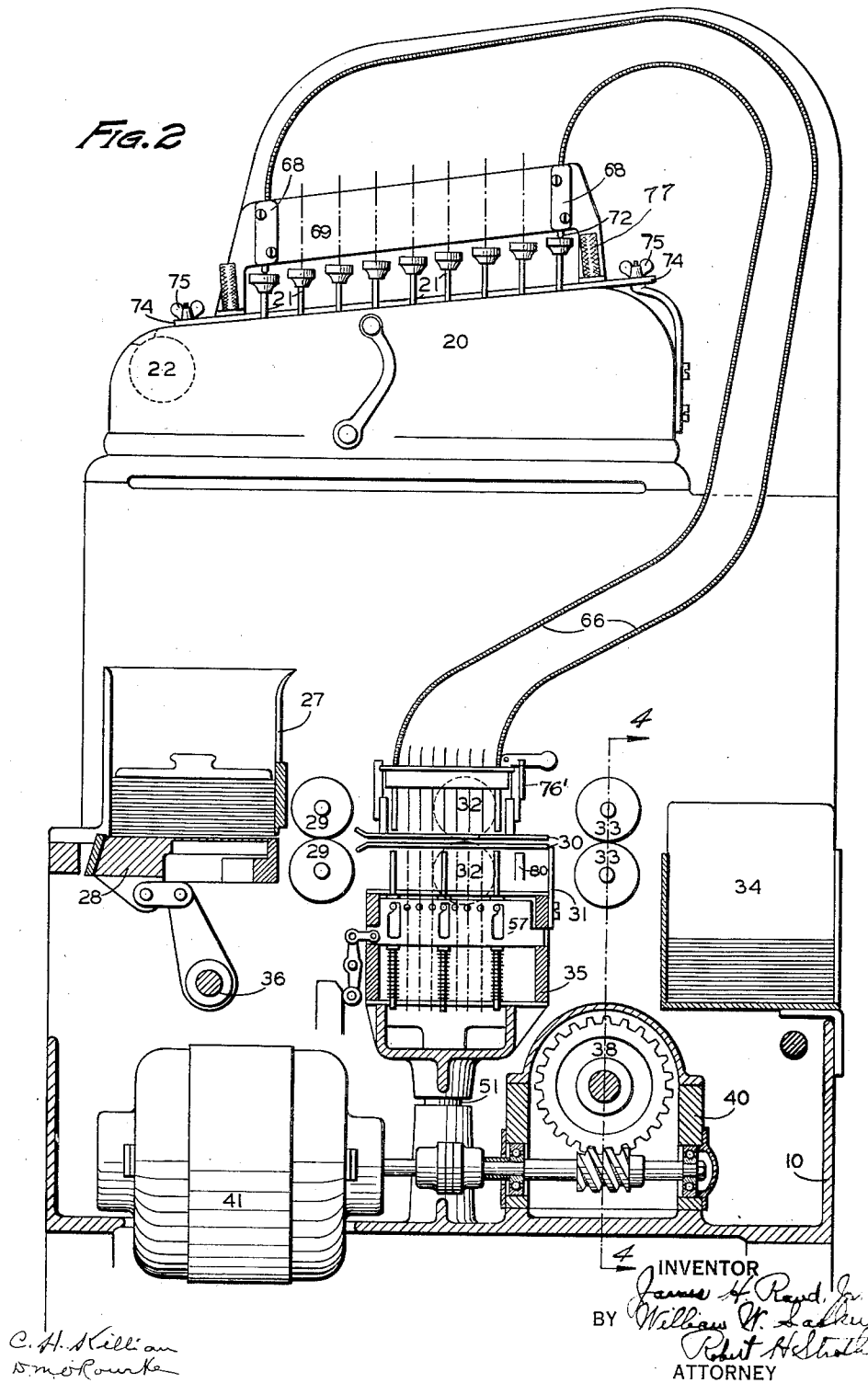
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TABULATING MACHINE

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Fig. 2



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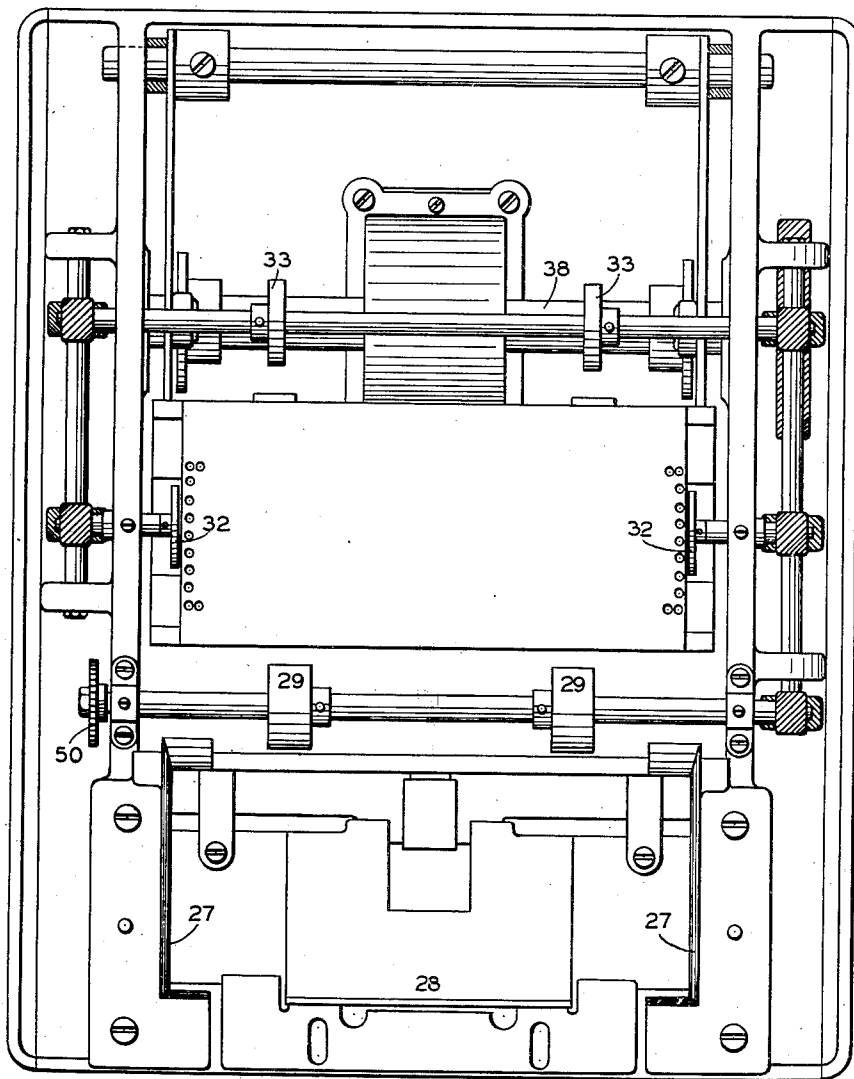
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TABULATING MACHINE

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6 Sheets-Sheet 3

Fig. 3



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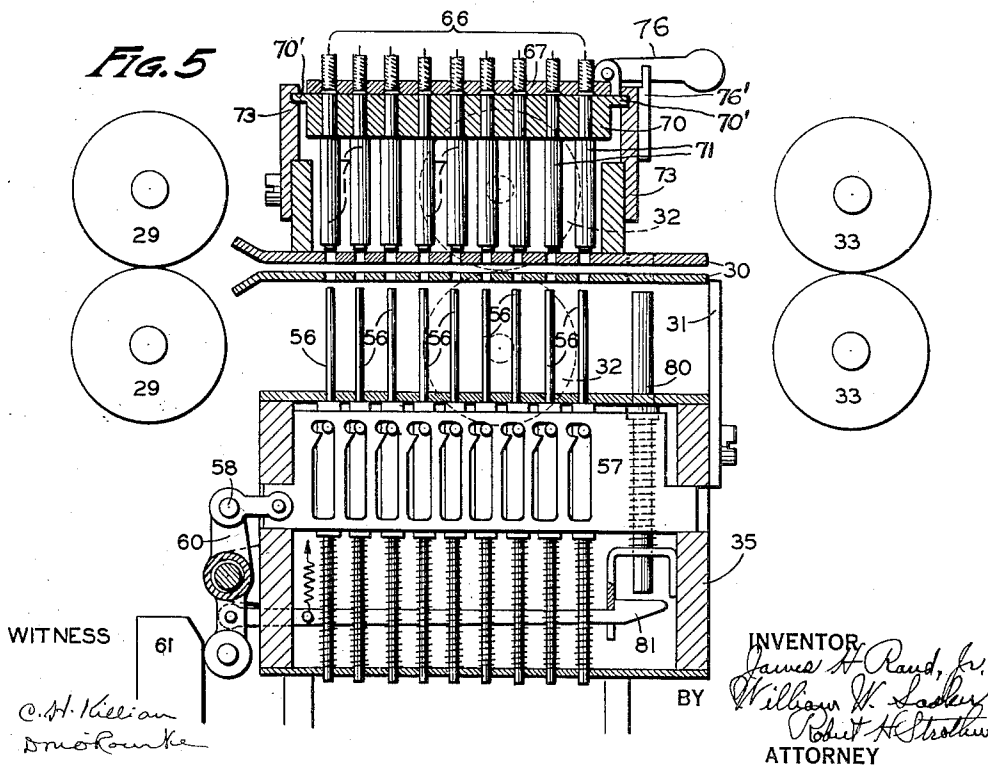
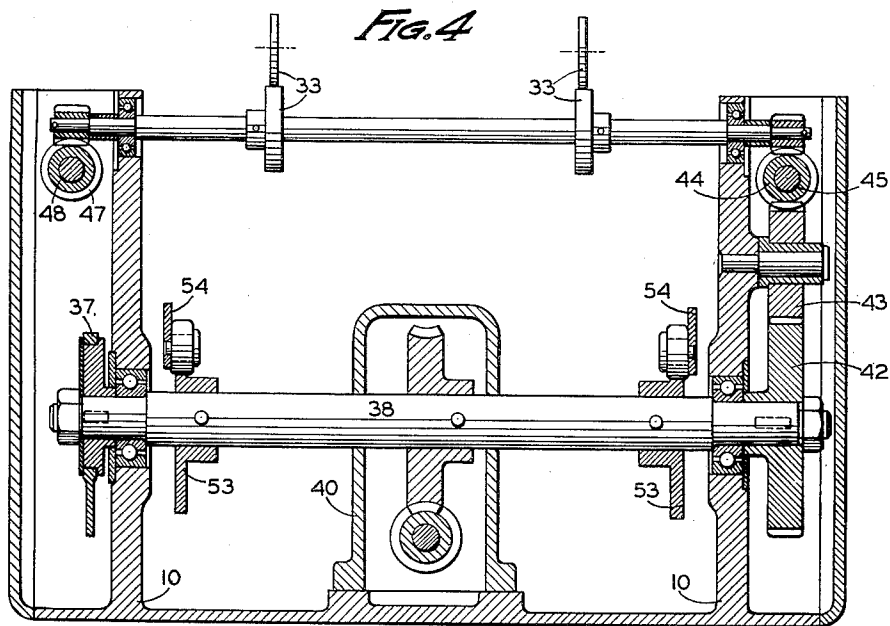
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TABULATING MACHINE

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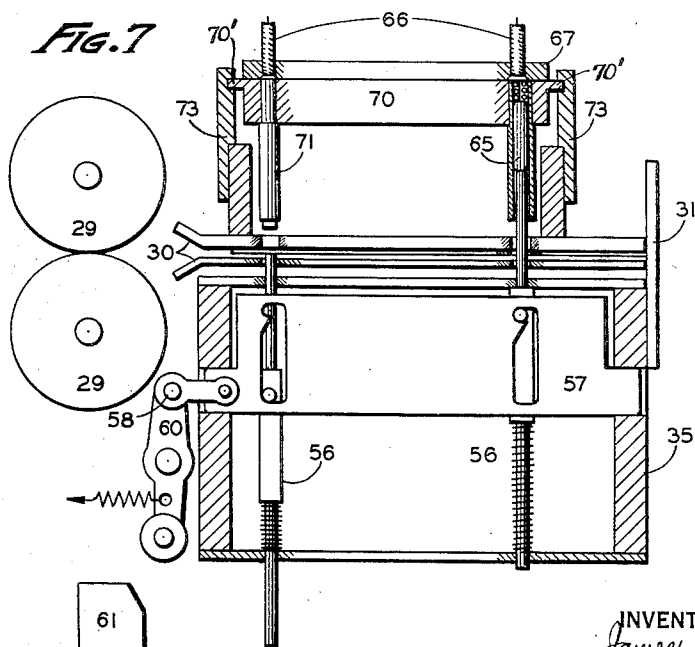
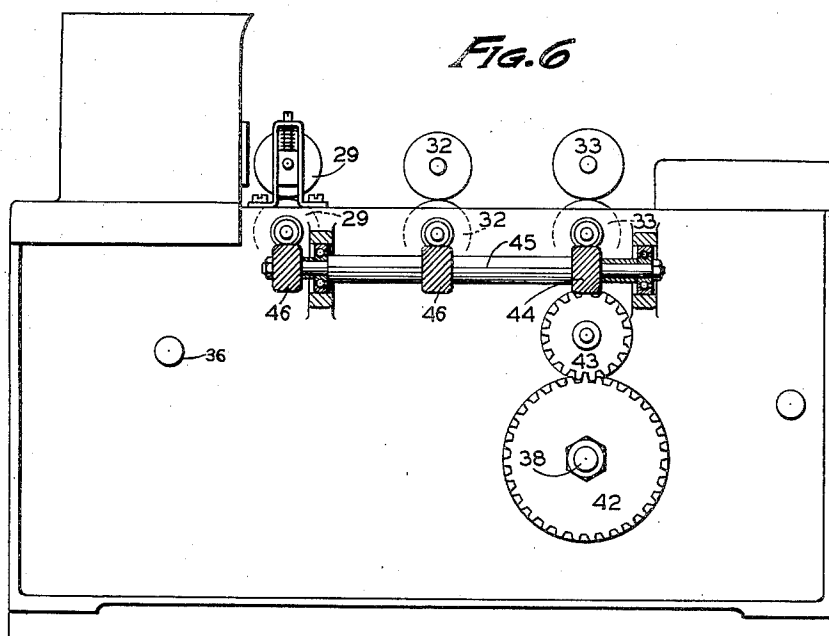
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TABULATING MACHINE

Filed April 2, 1932

6 Sheets-Sheet 5



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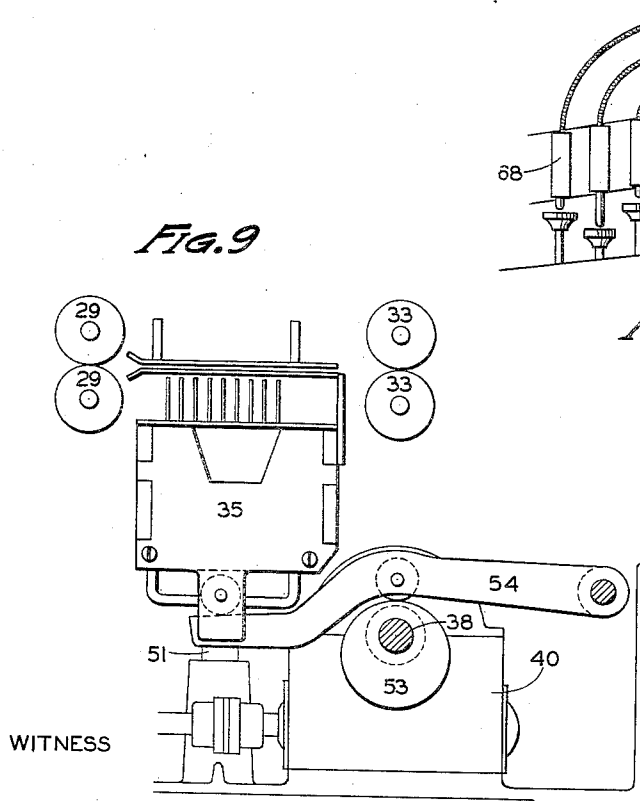
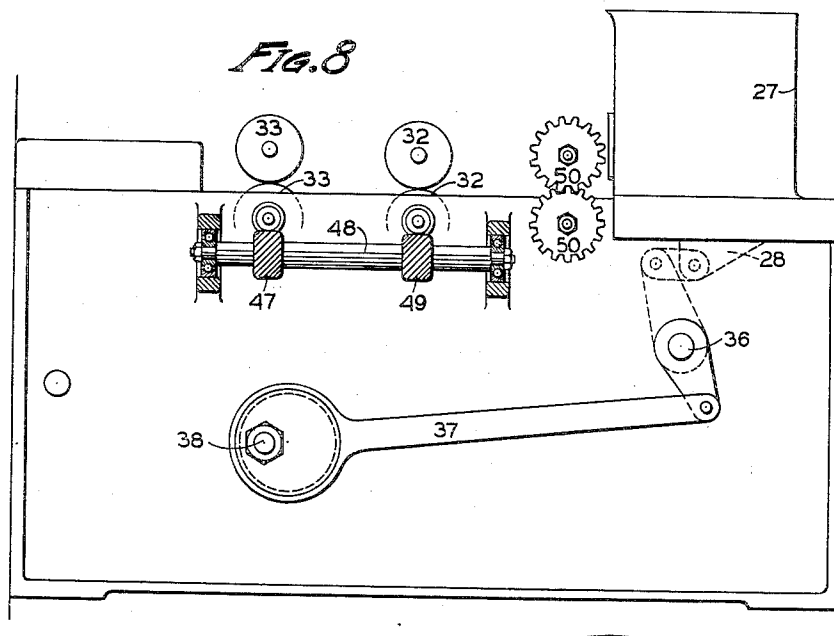
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TABULATING MACHINE

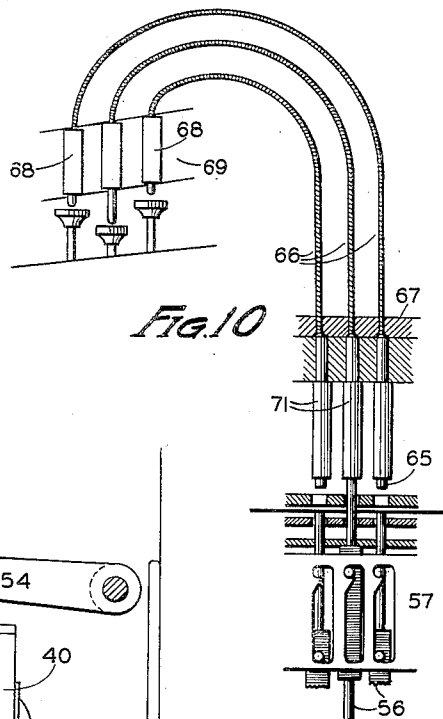
Filed April 2, 1932

6 Sheets-Sheet 6



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UNITED STATES PATENT OFFICE

2,059,277

TABULATING MACHINE

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Application April 2, 1932, Serial No. 602,656

2 Claims. (Cl. 235—58)

This invention relates to tabulating machines in which the information to be tabulated is first perforated in cards by means of a Powers punch and the cards are subsequently tabulated on a work sheet. The present Powers tabulating machines are provided with automatic printing mechanisms and although the listing of the detail cards is not always required, especially when running the machines for totals only, as in the "list total" equipment the construction of the tabulators is such that their speed can not be materially increased even when running the machines for list totals only. In some classes of work, in which the totals are culled from a great number of detail cards, even the printing of the totals could be dispensed with in the interest of speed, since it is an easy matter for the operator to copy the comparatively few necessary totals when displayed by suitable numeral wheels.

The machine of this invention provides a simple, relatively inexpensive device, which is adapted to operate upon the record cards, resulting from each sale of goods, to give a total of the desired character in a minimum time and at a minimum cost for equipment. The machine of the invention is adapted to cooperate with a manual computing machine of the type which is common in bookkeeping departments. That is, the sales record cards are passed through the sensing machine which senses the record thereon and transfers it to the standard ordinary manual tabulator. At the close of the sensing of the cards a total is recorded, which is visible to an operator and may be manually transcribed. In this way, a simple tabulation is obtained of the combined records of the sales cards in a quick and easy manner with an inexpensive device, which record may be transcribed by an operator for the store accounts, before the record cards are sent to headquarters.

The present invention relates to a machine having no printing mechanism which can be run at a much higher rate of speed. The machine includes a key operated calculating machine of the type in which the amounts are entered in accumulating wheels by the mere depression of denominational digit keys, such as the well known Burroughs electric calculator, the comptometer, and others. Examples of such machines are illustrated in the United States patents: Turck, 1,371,953, granted Mar. 15, 1921; Turck, 1,372,954, granted Mar. 15, 1921; Pasinski, 1,391,072, granted Sept. 20, 1921; Magnus, 1,845,164, granted Feb. 16, 1931. Said machine is associated with a novel mechanism for handling the Powers cards and is

arranged to set the denominational keys in the calculator from a set up corresponding to the perforations in the cards. The mechanism includes the usual card feed magazine in which the cards are stacked and from which they are ejected seriatim to a sensing position by means of a picker knife and feed rolls. The card is temporarily held in the sensing position and a sensing pin box having a plurality of denominational digit pins is moved against the card. The holes in the card determine which of the pins shall be locked relatively to the moving pin box and the pins not in line with the perforations in the card are held back against the card upon further movement of the pin box. The pins in line with the perforations are locked upon passing through the holes in the card and are then moved with the pin box.

According to this invention, the pins going through the holes in the card are operatively connected with the keys in the calculator of the same digit and denominational value by means of Bowden wires having casings suitably secured to a plate overlying the calculator keys. The other ends of the Bowden wires casings are secured to a carriage overlying the pin box, and the carriage is movable relatively to the several fields of the cards in order that predetermined information thereon may be selected for tabulation.

One object of this invention is to provide a machine which will operate from punched cards and record the information on key operated calculating and adding machines.

A further object is the provision of an inexpensive card controlled machine of simple mechanical construction.

Still another object is the provision of a card controlled device to be used in connection with key operated calculating machine.

Another object of this invention is to provide a universal device arranged for easy reception of various makes of calculating and adding machines and adapted to effectively control and record information from a punched card at a higher rate of speed than that attained with the more complicated tabulating machines.

In this machine, partial field information can be quickly recorded by setting the field selecting unit to a pre-determined card position.

Another feature of this invention relates to means whereby the calculating machine may be used independently of the card control section. The Bowden wire key operating device may be removed or turned aside to facilitate manual op-

eration of the calculating machine keyboard, or the calculating machine itself may be entirely removed and readily replaced. The card control device is moreover interchangeable with a variety of recording machines by the provision of adapters and selector transmitters, of special design. A multiple field selecting arrangement in the form of a series of field-setting instruments which will function with a series of associated recording machines, by connecting the various fields of the card with a series of calculating machines may be used. A selector transmitter arranged for duplex operation may also be used. In this instance each denominational and digit position of the sensing equipment cooperates with two Bowden instruments, each of which is associated with a recording machine. Such an arrangement provides means for procuring both totals and grand totals.

Referring to the accompanying drawings:

Fig. 1 is a front view of the machine, partly in cross-section showing the sensing pin box, the calculating mechanism and the Bowden wire connections therefor.

Fig. 2 is a cross-sectional view in elevation through the center of the machine, showing the drive mechanism, the sensing pin box and means for operating the calculating machine.

Fig. 3 is a plan view of the machine without the calculating machine and the Bowden wires.

Fig. 4 is a cross-sectional view in elevation through the line 4-4 of Fig. 2.

Fig. 5 is an enlarged view of the sensing pin box and the card field selecting carriage.

Fig. 6 is a side view of the machine showing the feed roll driving mechanism.

Fig. 7 is a diagrammatic view in elevation of the pin box in operated position, and shows one of the pins locked and actuating its associated Bowden wire connection.

Fig. 8 is a side view in elevation showing feed roll mechanism and the card feed operating linkage.

Fig. 9 is a side view in elevation showing the sensing pin box operating mechanism.

Fig. 10 is a diagrammatic view showing a portion of the sensing pin box in operated position and the manner in which the keys in the calculating machine are depressed.

The machine comprises:

(1) A base section 10 which contains the record feeding, sensing and storage mechanism, and the source of power;

(2) An intermediate section comprising primarily the standards 11 resting on the frame of the base section and the flexible Bowden wires extending from the base section to the computing section or sections as the case may be; and

(3) The computing section which comprises primarily a calculator, or calculators, 20 of the type fully disclosed in the above cited patents. These sections will now be described in the order recited.

Base section

The base section includes a frame supported card magazine 27 of the usual type having a reciprocatory card picker 28 for ejecting the lowermost card of the pack in the magazine 27 through a card throat to the pair of constantly rotating feeding rolls 29. The said rolls 29 feed the card into the sensing chamber 30, which consists of a pair of matched perforated plates having holes corresponding to every possible significant numerical perforation of a card (ordinarily

$9 \times 45 = 405$ pins). The card is temporarily held in the sensing chamber by a card stop 31 during the sensing or reading operation. Sensing or reading is effected by the reciprocating pin box 35 and after the card has been sensed and the card stop 31 lowered the card is fed out of the sensing chamber by the power driven skid rolls 32 to the pair of power driven ejecting rolls 33 thence into the storage magazine 34. The means for operating the above recited elements will now be briefly described in the order above recited.

The picker 28 is connected by a short link to an arm fixed on the shaft 36 to which is also fixed a second arm connected by the pitman 37 (Figs. 4 and 8) to an eccentric fast on the main shaft 38. The said eccentric may have any desirable form such as an assembly of an eccentric disk and a thicker flanged eccentric disk as shown in Figs. 4 and 8. The said main shaft 38 is supported and guided by suitable bearings in the base frame and may be driven in any convenient manner such as by a properly connected worm wheel reduction gearing 40 carried by the base of the machine, and the worm of said reduction gearing is directly driven by the armature shaft of a suitable motor 41 through a usual form of coupling.

The lower members of the pairs of rolls 29, 32 and 33 are directly geared to the main shaft 38 (see Fig. 6) by a usual form of a spiral gearing train comprising a gear 42 fixed to said shaft, a frame supported idler 43, and a pinion 44 fixed to a frame supported jack-shaft 45. Also fixed to the jack-shaft 45 are two spiral gears 46. Each of the gears 44 and 46 meshes with a pinion fast on the shaft of each of the lower members of the roll pairs 29, 32, and 33 thus effecting a positive drive thereof. The upper roll 29 is positively driven from the lower by a pair of meshing gears 50 (Figs. 3 and 8). The skid rolls 32 are divided into two pairs of disks at opposite sides of the machine as is best shown in Fig. 3. The lower shaft of the roll pair 33 carries a pinion at the opposite side of the machine which meshes with a pinion 47 (Figs. 3, 4, and 8) fast to the auxiliary jack-shaft 48, which carries a second pinion 49 for driving the lower roll of the other pair of skid rolls. All other rolls are frictionally driven in the usual manner, and have the usual spring lever mechanism for holding them in contact with the lower rolls. See, for example, the corresponding mechanism in the patent Powers 1,245,502 granted Nov. 6, 1917.

The sensing or reading mechanism 35 comprises a reciprocatory frame which is guided for accurate rectilinear movement by a pair of posts or studs 51 rigid with the bottom of the frame 35 working in long hollow bosses integral with the main frame, and the frame 35 is urged downwardly by the powerful springs 52 best shown in Fig. 1. The mechanism for reciprocating the frame 35 (best shown in Figs. 4 and 9) comprises a pair of cams 53 fast to the main shaft 38 and a corresponding pair of levers 54 operated by said cams and whose pivots are supported in main frame. If desired an anti-friction roll may be included between the cam 53 and the lever 54; and also between the lever 54 and the frame 35, for reducing the friction and increasing the smoothness of operation.

The box or frame 35 contains a series of columns of spring pressed sensing pins 56; one column of pins for each field column of the card to be sensed; which are guided by perforated plates near the top and bottom of the frame 35. Each

of the pins 56 is provided with a flattened portion and a lateral pin near its midpoint for cooperating with the spring pressed locking slide 57 associated with each column of pins. The spacing and arrangement is such that a locking plate 57 occupies nearly all the space between consecutive columns of pins thus constraining the said pins against undesired rotations. Each of the locking plates 57 is in disabled position as a normal position as shown in Fig. 5, and each of said plates is connected by a short link to a universal bar 58 which in turn is mounted as a bail at the upper ends of the arms 60, one of which has a downward extension and anti-friction roll riding on the edge of a fixed cam 61. All the slides are urged towards locking position by a strong spring surrounding the shaft which carries arms 60 and which is shown in conventional style in Fig. 7. This locking mechanism is necessary, for the springs tending to elevate the pins 56 are considerably inferior to the springs which hold the lower plungers of the Bowden wires in their lowered positions. Also mounted on the box or frame 35 is a blade 31 which acts as a card stop for a card in the sensing chamber 30. When the frame or box 35 is elevated the card stop 31 closes the exit of the card chamber 30 and the sensing pins 56 travel upwardly through the perforations of the lower plate of the sensing chamber; and thence some of them pass through the perforations of the card and thence through the upper perforated plate of the sensing chamber. At this time the roll on arm 60 has passed beyond the effective portion of cam 61 thus permitting the strong spring to shift locking plates 57 to locking position. Those pins which have been stopped by the card in the sensing chamber have had their locking pins forced below the locking shelves or ledges of the locking plates 57 but those which have found perforations are latched against downward movement, and remain in this position during continued upward movement as is illustrated in Figs. 7 and 10.

When there is no card in the sensing chamber it is necessary to disable (or prevent action of) all the sensing pins 56. This is done by merely sensing the presence or absence of a card. A "presence of card" sensing pin 80 is guided for vertical movement and is urged upwardly by a suitable spring to sense the presence or absence of a card. The lower end of the pin 80 is just above a spring urged catch 81 which latches over a bracket fixed to the frame 35 when the said frame is in its lowermost position. The catch 81 is pivoted to the arm 60, which it will be remembered disables all the latches 57 when the frame 35 is in its lowermost position, hence the catch 81 will remain in this position unless sensing pin 80 is forced downward. The pin 80 is forced downward when and only when there is a card in the sensing chamber. Hence the slides 57 will be locked in ineffective position by catch 81 when there is no card in sensing chamber 30, and therefore, the sensing pins will be ineffective to elevate the cores of the Bowden wires of the intermediate section.

Intermediate section

The mechanism for locking the pins 56 corresponding to perforations in the sensed card and for driving said pins positively upwardly was described under the preceding heading. The mechanism for transmitting a motion represented by the locked pins to the calculating device will

now be described. It has been hinted, hereinabove that, ordinarily, a single field of the card only is tabulated. The maximum size of a single numerical field is about ninety perforation positions in any pre-determined or desired location on the card. Such a field is represented in section at the top of Fig. 5 and in end view in Fig. 1. The pins 56 which pass through perforations meet spring pressed plungers 65 (see Fig. 7) which are connected to the cores of the corresponding Bowden wires to transmit the movement to the computing or tabulating section. The casing of each Bowden wire 66 is anchored at its lower end into a countersunk hole in the plate 67 by any suitable means such as ring staking or soldering. The casings of the upper ends of the Bowden wires 66 are anchored in any suitable manner, such as a friction clamp 68, to a plate 69. The plate 67 is rigidly attached to a second and thicker plate 70 which is correspondingly perforated to receive the bushings 71 which serve as guides for the plungers 65. The plungers 72 at the upper ends of the Bowden wires are similarly guided by the clamps 68 and therefore need not be further described.

The connected plates 67 and 70 contain as many Bowden wires as the possible significant perforations in a numerical field, and the lower of said plates is provided with tongues 70' which project into grooves in the parallel supporting rails 73 which in turn are supported on the top plate of the sensing chamber 30. The construction and arrangement is such that the plates 67 and 70 can be adjusted lengthwise of the said rails 73 to locate any desired field for tabulation. When a desired field has been located the catch or pawl 76 is turned down, as shown in Figs. 2 and 5, between a pair of teeth in a crenelated bar 76' attached to one of the rails 73.

The capacity of the common punched card is 45 columns and the capacity of the usual maximum numerical field is about 9 columns, therefore the plates 67 and 70 can have 5 possible positions for tabulating cards which are composed of "maximum" fields. It sometimes happens that the field to be tabulated has less than 9 columns. In order to provide for such contingency there is one plate 69 (Fig. 2) for each column of Bowden wires which is detachably mounted on a frame 74 by any suitable means such as knurled screws 77. When it is desired to tabulate in fields less than the maximum the undesired plates 69 are detached from the frame 74. If one or more mid plates 69 are detached the machine may operate as an ordinary split unit as is well known in the tabulator art. Again if desired two or more sets of Bowden wires 66 with their carriages 67-70 may be provided for a series of calculating machines.

One convenient way of attaching a frame 74 to a calculating machine consists of anchoring screws 75 in any suitable manner to the case, or frame, of a suitable non-listing calculator so that the plates 69 attached to the frame 74 may have the plungers 72 properly located over the keys of the calculator 20.

Computing section

The computing section comprises primarily a non-listing calculator of conventional and well known form. Several modes of calculation will now be briefly described.

When it is desired to merely add a series of numbers occurring as perforations in punched cards it is first necessary to locate the calculator

as described hereinabove and attach the frame 74 with the desired plates 69 with their plungers 72 over the corresponding keys of the calculator, then set the carriage 67—70 over the desired field of the sensing chamber. The sorted perforated cards are placed in the magazine 27 and fed through the machine as described hereinabove. It is desirable that the calculator have key depressions which are substantially independent of the value of the key to be depressed. Machines of this type are fully described and illustrated in the United States Patents—Pasinski, 1,391,072, granted Sept. 20, 1921; Turck, 1,371,953, granted Mar. 15, 1921; Gooch, 1,327,319, granted Jan. 6, 1920. If the key depression varies slightly as in the Pasinski and Gooch constructions the variation can be compensated by properly proportioning the length of the Bowden wires 66 between their end plungers in an obvious manner so that there are corresponding amounts of lost motion between the plungers and the calculator keys. No such variations of lost motion are necessary for machines of the Turck type. In this case it is however necessary to properly regulate the speeds of the driving motor 41 and the driving motor of the calculating machine so that the former will not overrun the latter.

In some instances it is desirable to obtain both sub and grand totals. Such can be obtained by a proper choice of the calculator 20; that is choosing a calculator provided with the requisite two totalizers. Examples of such calculators are: Gooch, 1,327,319, granted Jan. 6, 1920; Gooch, 1,327,320, granted Jan. 6, 1920.

What we claim as new and desire to secure by Letters Patent is:

1. The combination of a calculating machine

having a plurality of keys for each order of digits, an analyzer having a plurality of setting members arranged in fields and columns, a plurality of flexible connections, a carriage to which one end of each connection is secured, a guideway along which the carriage can be moved to bring one end of each connection into operative relation with one of the setting members in a selected field, a plurality of frames, each adapted to secure the other ends of the connections associated with one column of the setting members, and means for securing any frame to the calculating machine with the connections carried thereby in position to depress the keys of a selected order of digits whenever said connections are actuated by the setting members.

2. The combination of a calculating machine having a plurality of keys for each order of digits, an analyzer having a plurality of setting members arranged in fields and columns, a plurality of flexible connections, a carriage to which one end of each flexible connection is secured, a guideway along which the carriage can be moved, means for locking the carriage at predetermined points along the guideway to bring one end of each connection into operative relation with one of the setting members in any desired field, a plurality of frames, each adapted to secure the other ends of the connections associated with one column of the setting members, and means for securing any frame to the calculating machine with the connections carried thereby in position to depress the keys of a selected order of digits whenever said connections are actuated by the setting members.

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