

March 14, 1939.

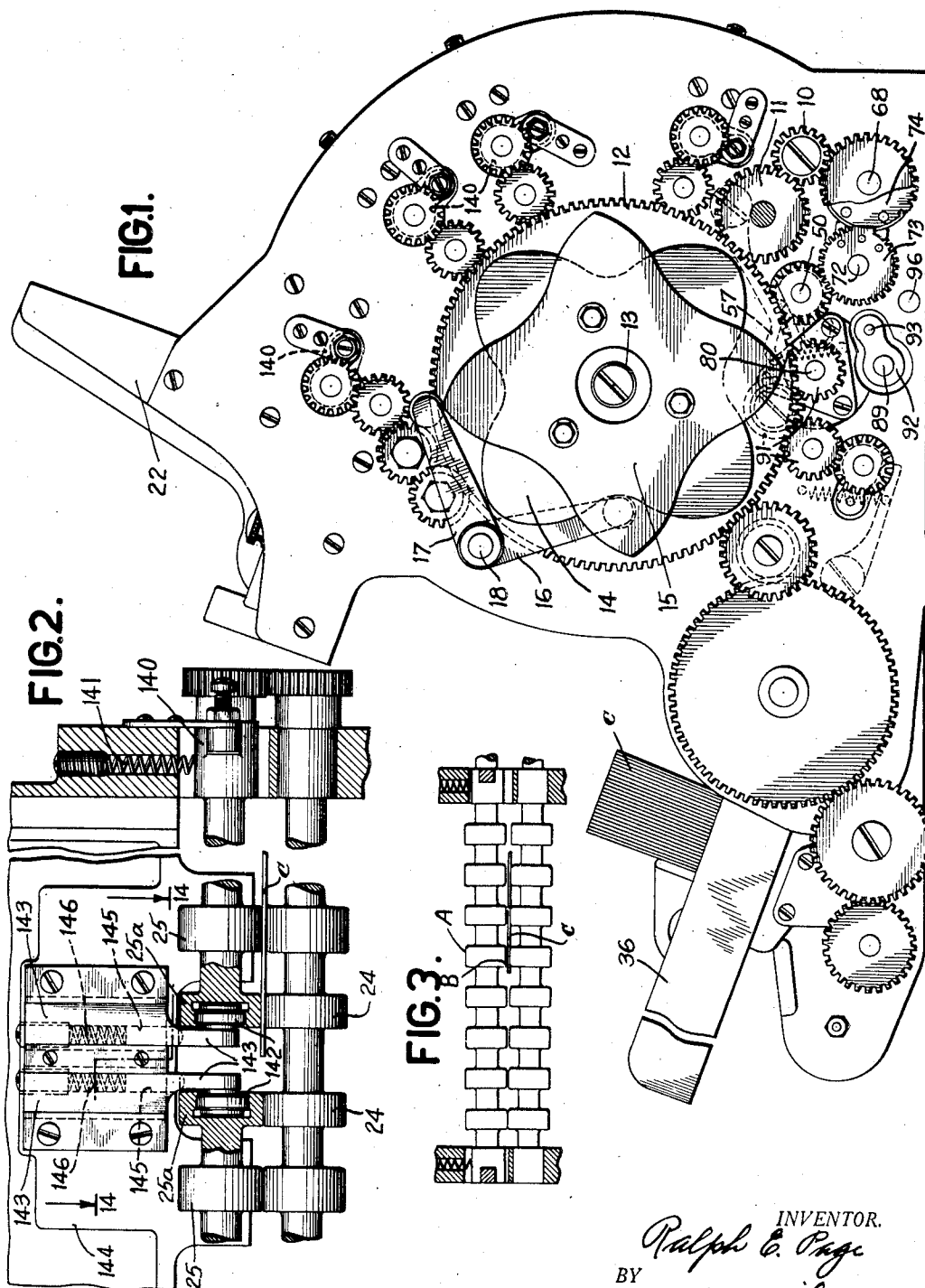
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2,150,243

STATISTICAL CARD OPERATED MACHINE

Filed Aug. 23, 1934

6 Sheets-Sheet 1



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FIG. 4.

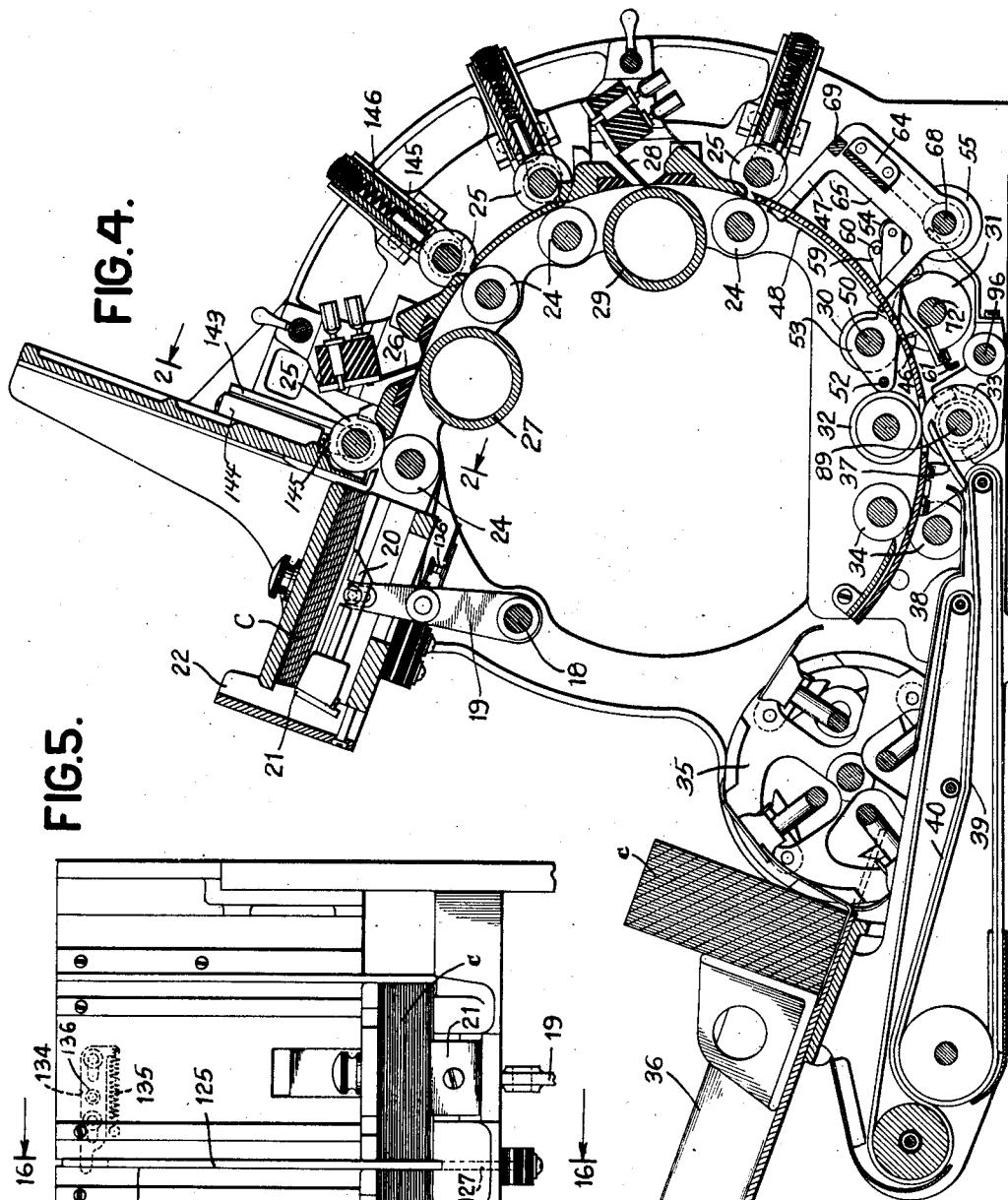
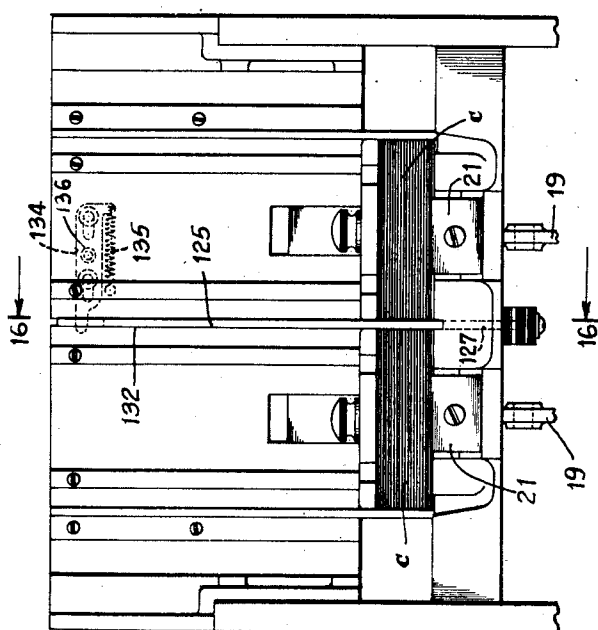


Fig. 5.



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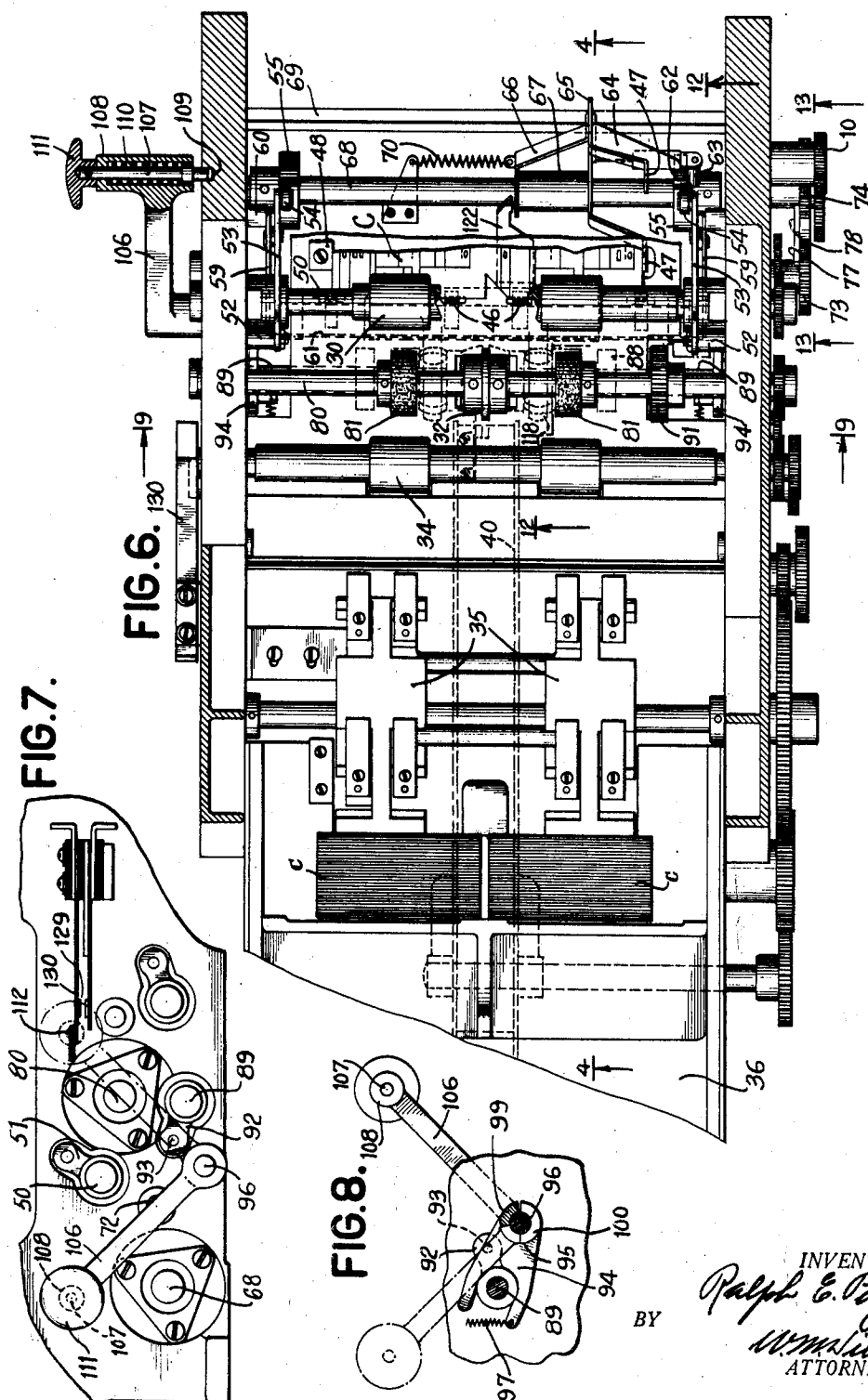
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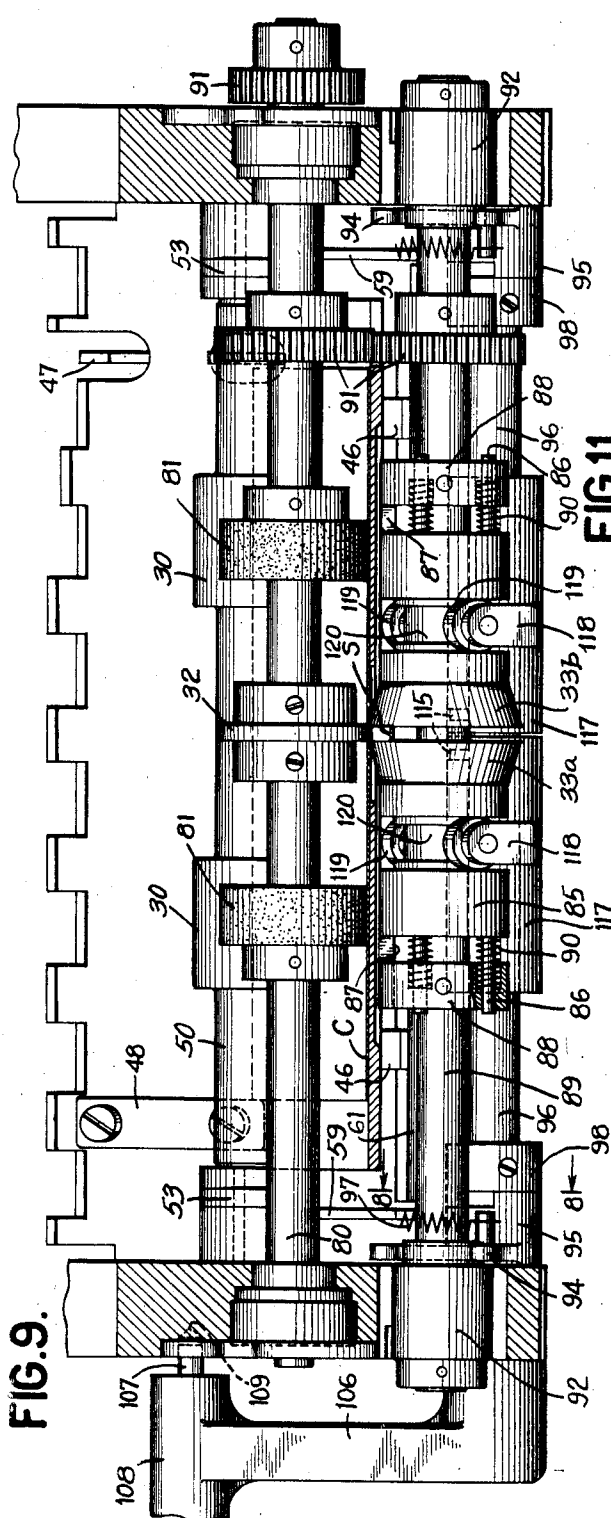
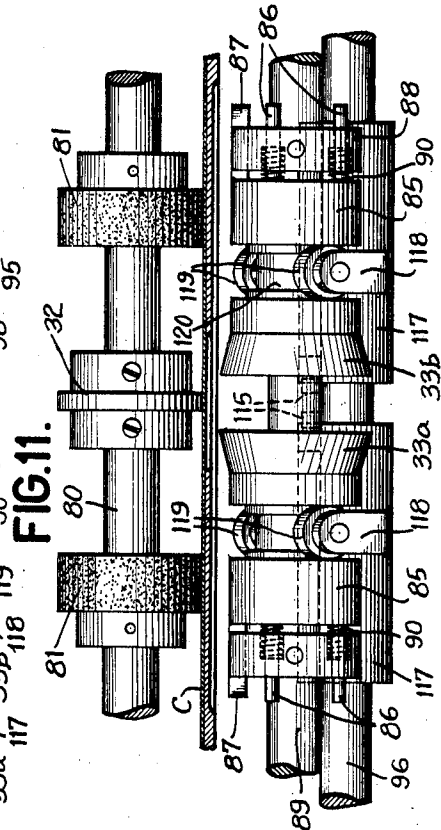
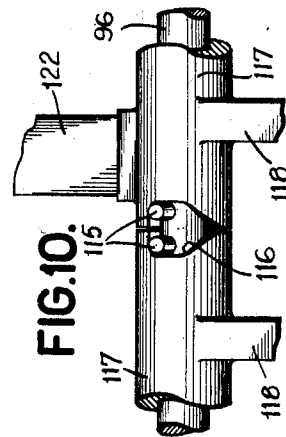
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STATISTICAL CARD OPERATED MACHINE

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6 Sheets-Sheet 4



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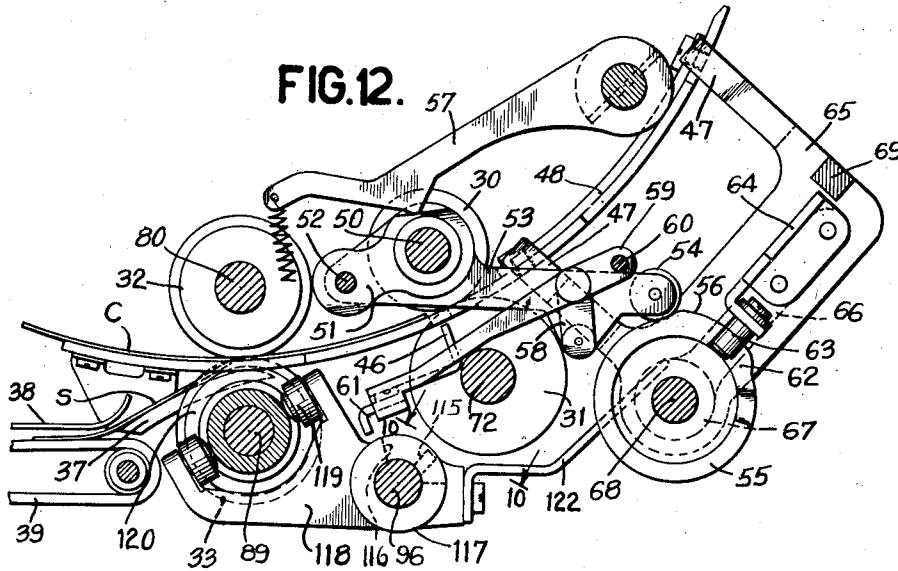
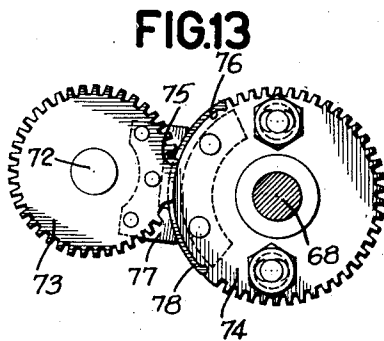
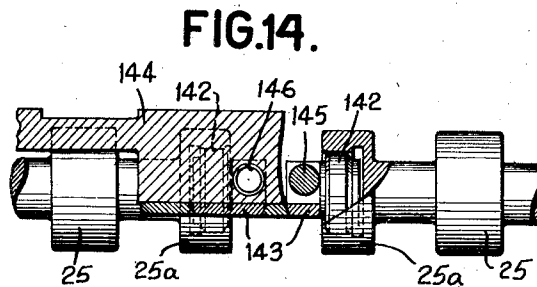
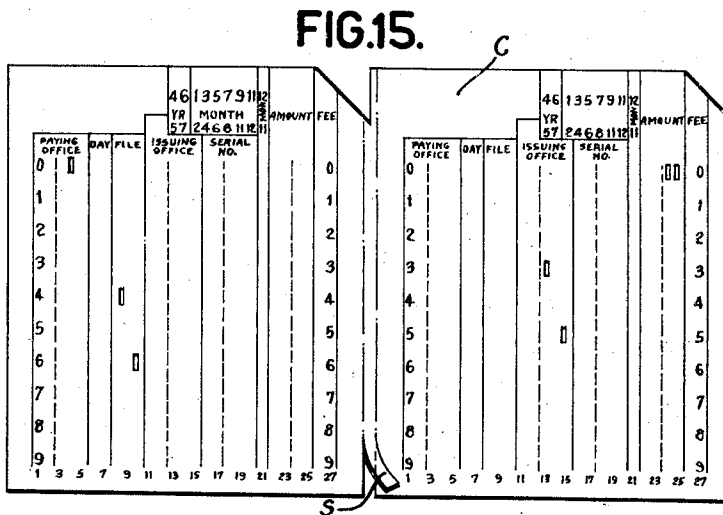
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6 Sheets-Sheet 5



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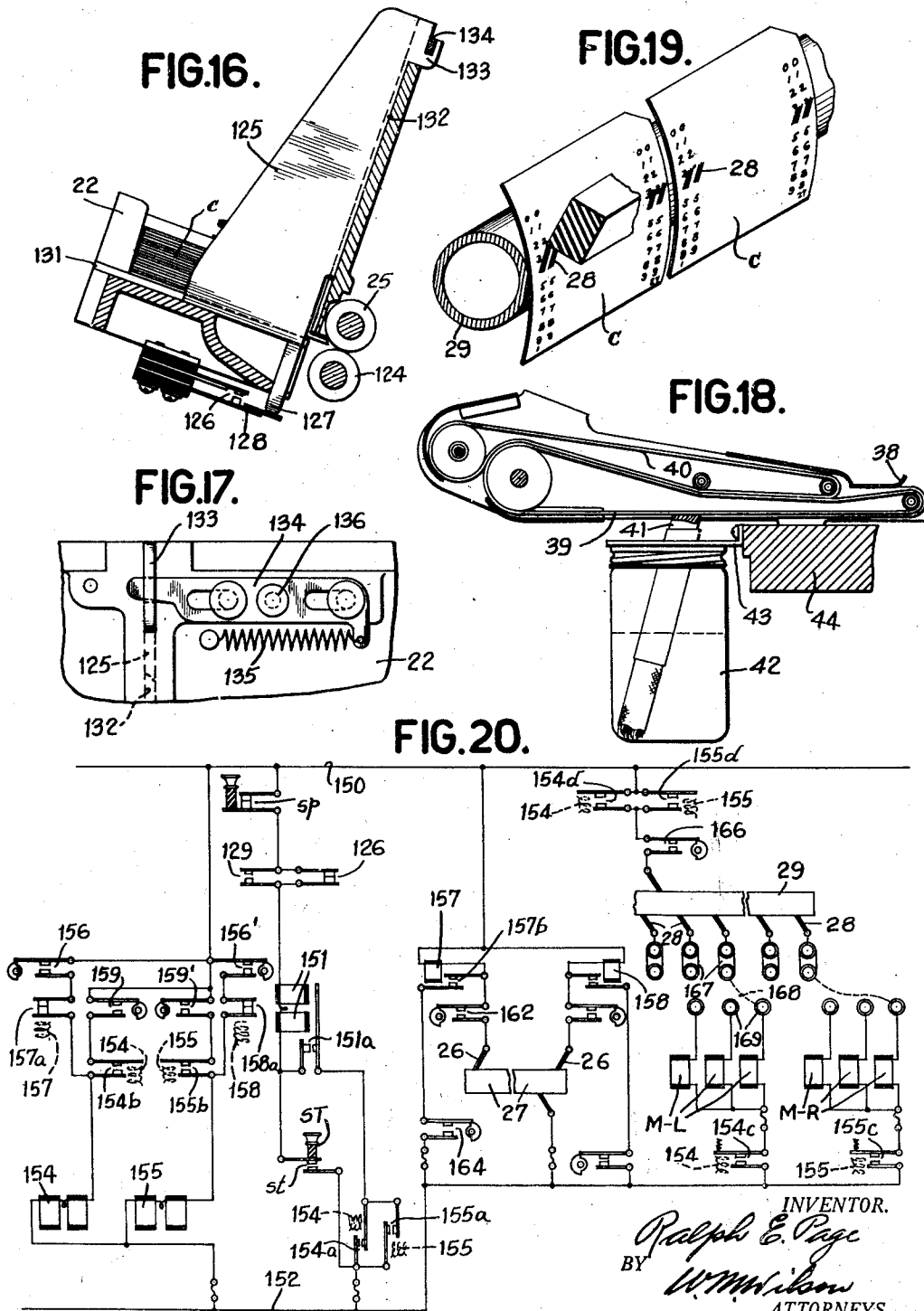
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2,150,243

STATISTICAL CARD OPERATED MACHINE

Filed Aug. 23, 1934

6 Sheets-Sheet 6



UNITED STATES PATENT OFFICE

2,150,243

STATISTICAL CARD OPERATED MACHINE

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Application August 23, 1934, Serial No. 741,029

4 Claims. (Cl. 235—61.6)

This case relates to accounting machines controlled by perforated, data bearing cards and is directed to the following objects:

To feed separate, individual cards abreast through the machine, each to control an accounting section, thus multiplying the card handling capacity of the machine.

To continue operation of the machine so long as such individual cards are feeding through one side of the machine even though the feed of cards abreast has ceased.

To feed small cards through the machine in the same column relationship to analyzing brushes as when larger cards are feeding through the machine.

To control by means of the smaller cards the effectiveness of an entire group of analyzer brushes and accounting elements and to cut out of operation a group of such accounting elements when small cards are not feeding along one side of the machine but feeding along the other side of the machine.

Other objects and advantages will be brought out in the following parts of the specification and will appear from the drawings.

In the drawings:

Fig. 1 is a side view of the machine with the gear case removed;

Fig. 2 is a section on line 2—2 of Fig. 4, showing the new form of feed for a small card;

Fig. 3 is a representation of the old form of feed in connection with a small card;

Fig. 4 is a section on line 4—4 of Fig. 6;

Fig. 5 is a rear view of the supply hopper when containing a double stack of small cards;

Fig. 6 is a horizontal sectional view through the machine below the lower analyzer section;

Fig. 7 is a detail of the operating means for disabling the splitter and correlated mechanism;

Fig. 8 is a section on line 8—8 of Fig. 9;

Fig. 9 is a section on line 9—9 of Fig. 6;

Fig. 10 is a detail section along lines 10—10 of Fig. 12;

Fig. 11 shows a part of Fig. 8 with the splitter in disabled position;

Fig. 12 is a detail of the card aligning and squaring mechanism taken along line 12—12 of Fig. 6;

Fig. 13 is a section on line 13—13 of Fig. 6;

Fig. 14 is a section on line 14—14 of Fig. 2;

Fig. 15 shows the large card before it is completely slit into small cards;

Fig. 16 is a section through the supply hopper along lines 16—16 of Fig. 5;

Fig. 17 is a detail of the latch means for holding a partition plate in the supply hopper;

Fig. 18 is a detail of static removing means applied to the ejector belts which eject the strips cut out of the large card when it is divided into two;

Fig. 19 is a view showing the relation of the lower analyzing means to a pair of small cards passing abreast through the machine, and;

Fig. 20 is a circuit diagram of the parts of the machine pertinent to the invention.

The invention will be explained in connection with a machine such as disclosed in Patents 1,827,259 and 1,926,883, although it is generally applicable to other tabulating or analogous machines.

A general explanation of the machine and its purpose will first be given. The control cards are provided with parallel columns containing information according to a selected code. The present invention makes use of the Hollerith code in which each column has ten index point positions, any one of which may be perforated to represent 0 to 9 according to its differential position in a column. Some of the columns of a card contain numerical values or amounts while other columns contain classification data pertinent to the amount items. Thus as indicated in Fig. 15 the large card C is adapted for use in some such place as a post office where money orders are issued. It will be further noted that the large card C has two duplicate sections which, for convenience, may be referred to as small cards c. Each card c is perforated with the information relative to a different money order so that the information on one section may have entirely no relation to the information on the other section except possibly for common classification data. It is thus feasible that the large card C be separated into its sections and these latter be considered and handled as separate, individual, small cards for sorting, tabulating, or the like purposes.

In punching the information on cards, it is however more convenient, saves time, and is better suited to the ordinary card punching machine that the two sections be together in the form of the large card to be perforated with the information related to the two different money orders. It is also convenient after the punching of the large card to tabulate the information regarding the two money orders from the large card to save time and wear on the machine. However, after the tabulating operations, it is usually necessary to separate the large card so that each section c related to a different trans-

action may be separately sorted. Thus the two sections of a card may each relate to a different issuing office or file and in some cases it would be necessary to sort the cards according to the issuing office or file. In such event, the separate sections of the card must be separately sorted and it follows that for this purpose the large card C must be slit into two individual cards c.

In brief, then, the present machine provides means for tabulating the information on the large card C and after completion of the tabulation provides for shearing the cards into its separate duplicate sections c. The machine is also adapted to tabulate information from a large card without shearing it. Further, the machine is adapted to feed the small cards c as individual cards and tabulate information therefrom.

With this general explanation in mind the machine will now be explained in detail, first with regard to the operation on a large card C and the slitting of the latter into small cards c.

Referring to Fig. 1, gear 10 is constantly rotated during tabulating operations by suitable clutch connections from a motor (not shown). Gear 10, through idler 11, drives central gear 12. Shaft 13 of gear 12 carries complementary, star-shaped cams 14 and 15, respectively engaged by follower arms 16 and 17 of a common shaft 18. The projections of one such cam lie intermediate the projections of the other cam and the rise of one projection of a cam coacts with and positively moves its follower arm at the same time that the drop of a projection of the other cam is permitting its follower arm to recede. Thus, cam 14 is positively moving arm 16 and shaft 18 clockwise (as viewed in Fig. 1) at the same time as arm 17 is moving into a depression of cam 15 and cam 15 is positively moving arm 17 and shaft 18 counterclockwise while arm 16 is moving into a depression in its cam 14. In this manner, shaft 18 is positively rocked in forward and return directions and no dependence placed on impositively acting springs.

Referring to Fig. 4, shaft 18 carries two picker arms 19 (see Fig. 5) connected to slides 20 provided with card pickers 21. Upon clockwise movement of shaft 18, pickers 21 move the bottom card C of a stack in supply hopper 22 out of the hopper and into the grip of a first pair of feed rolls 24 and 25. It will be noted that the feed of the cards by the pickers is intermittent and thus the successive cards are fed at suitable distances apart. Feed rolls 24 and 25 and three other such pairs of successively disposed and similar feed rolls advance the card first between brushes 26 and contact roller 27 of the upper analyzing section and then between the brushes 28 and common contact roller 29 of a lower analyzing section.

As seen from Fig. 1, the inner rolls 24 are geared for rotation to central gear 12 while the outer rolls 25 are geared to the inner rolls.

The last pair of feed rolls 24 and 25 feeds the card to the pair of feed rolls 30 and 31, which moves the card through coating rotary slitters 32 and 33. These slit the card C into small sectional cards c which are seized by ejecting rolls 34 and advanced to rotary stacker 35 which delivers the small cards to the receiving magazine 36. In slitting the large card, a narrow strip S (see Fig. 15) is cut out. This strip curls downwardly during the cutting operation, abuts guide plate 37 and moves below a plate 38 and onto a belt 39 (see Figs. 4, 12, and 18). The strip is

then gripped between belt 39 and a coating belt 40 and ejected from the machine.

In dry weather, it has been found that because of static, the strip S clings to the surface of one of the belts and travels around again with the belt thereby interfering with the ejection of the strips S which follow. To overcome this condition, the surfaces of the belts are kept wet by a wick 41 (see Fig. 18) which contacts the lower belt 39. The wick is set inside a jar 42 containing water and secured by bracket 43 to the frame 44 of the machine. The wetting of the belts relieves the static condition and overcomes the tendency of the strips S to cling to the belts.

In order to slit the large card C accurately into duplicate sectional cards c, it is desirable to positively align or square the card with respect to the slitters before the slitting operation. For this purpose, the feed of the card is interrupted before the slitting operation, the leading edge of the card is positively engaged to stop the card, and the card is moved transversely of the machine against a side stop.

Referring to Figs. 4, 6, and 12, when card C leaves the lower analyzing section, it is fed by the last pair of rolls 24 and 25 to rolls 30 and 31. When the rear edge of the card leaves the grip of rolls 24 and 25, its forward edge is just emerging from rolls 30 and 31. At this time, rolls 30 are moved away from rolls 31 to interrupt the feed of the card. Simultaneously, transverse stop fingers 46 move upwardly into the path of the card and engage the forward edge of the later to positively stop the card and align its forward edge in a transverse direction. While engaged by stop fingers 46, a pair of longitudinally aligned side fingers 47 engage one side of the card and shift the card transversely to abut its opposite side with an elongated bar 48 (see Figs. 6 and 9) forming a side stop and locator. The card is thus squared with respect to the slitters and accurately and positively positioned in a predetermined location prior to the slitting operation. After the card has been so positioned, stops 46 move down out of the path of the card, side fingers 47 are retracted, and rolls 30 and 31 come together again to resume feed of the card.

Separation of rolls 30 and 31 is brought about by movement of rolls 30 away from rolls 31. For this purpose, the shaft 50 of rolls 30 is rockably mounted at each end by means of an arm 51 on a stub shaft 52. Also pivoted to each stub shaft 52 is a lever 53 which intermediate its ends rotatably embraces shaft 50 and and at its free end carries a follower roller 54. The roller 54 rides along the periphery of a wheel 55 having a short cam bump 56. When roller 54 rides up cam bump 56, it causes lever 53 to rock counterclockwise (as viewed in Fig. 12) against resistance of a spring-pressed rocker arm 57. The counterclockwise movement of levers 53 raises shaft 50 to separate feed rolls 30 from companion rolls 31.

Connected to each lever 53 by means of a link 58 is a lever 59 pivoted to the frame on pins 60. The two levers 59 at opposite sides of the machine (see Fig. 6) carry between them a transverse bar 61 to which are fixed the stops 46. Accordingly, when levers 53 are rocked counterclockwise to raise feed rolls 30, through links 58 they effect clockwise rocking of levers 59 about pins 60 to thereby raise stops 46 and position them in the path of the card. The stops 46 positively arrest the card and prevent its reaching indeterminate positions due to its own momen-

tum or to an overfeed by rolls 30 and 31 or by rolls 31 alone after the rolls 30 have been moved away from the card. Further, stops 46 align the forward edge of the card in a transverse direction at right angles to its line of feed.

Wheel 55 in addition to its peripheral cam bump 56 also has on its outer face a cam depression 62 (see Fig. 6). Wiping the outer face of wheel 55 is a follower roller 63 which is carried by a bracket 64 secured to a plate 65 which is formed at its upper end with the slide fingers 47. Bracing plate 65 is bent plate 66. Plates 65 and 66 are secured to the opposite sides of a sleeve 67 rotatably and slidably mounted on shaft 68 of wheel 55. To constrain the plate 65 to slidable movement, it is notched at the rear to receive and slide along a guide bar 69. When cam bump 56 of wheel 55 coacts with follower 54 of levers 53 to raise feed rolls 30 and stops 46, cam depression 62 in the face of wheel 55 reaches follower 63 of the side locating device and permits a spring 70 (see Fig. 6) to move the side locating device with its fingers 47 towards the side stop bar 48. In this movement, fingers 47 engage the adjacent side of the arrested card and shift the card until its far side engages stop 48. The position of fingers 47 and the card after this operation is indicated in Fig. 6.

It is also desirable to stop rotation of lower 30 or outer feed rolls 31 when the card is arrested and aligned in proper position in order that the rolls 31 by frictional coaction with the card do not attempt to advance it after rolls 30 have been raised and stops 46 moved into the path of the card. Rolls 31 are on a shaft 72 (see Figs. 4, 12, and 13) provided with a gear 73 (see also Fig. 6) meshed with gear 74 on the shaft 68 which also carries cam wheel 55. Shaft 68 is rotated by constantly rotating, main gear 10. Referring to Fig. 13, it is seen that gears 73 and 74 have complementary blank portions 75 and 76, respectively. To the sides of the gears 73 and 74 are fastened similarly shaped complementary plates 77 and 78. Due to these plates 77 and 78 and blank portions 75 and 76, the rotation of gear 73 by gear 74 is intermittent and for a short period, gear 74 rotates without effecting rotation of gear 73, its shaft 72, and feed rolls 31. The coaction of plates 77 and 78 further holds the shaft 72 positively against rotation. The idle period of gear 73 substantially coincides with the period of separation of rolls 30 and 31.

Briefly, the above operations of interrupting the feed of the card and squaring it are.

Separation of rolls 30 and 31, interruption of rotation of rolls 31, raising into action of cross stops 46, and transverse movement of side fingers 47. The above operations all take place in a brief interval but sufficient to square the card after which rolls 30 return to coaction with rolls 31, thereby holding card in accurate position, cross stops 46 drop, side stops 47 move away from the side of the card, and rotation of the rolls 31 resumes to feed accurately positioned card C to the slitters 32 and 33.

Referring to Figs. 9 and 11, upper rotary slitter 32 is a disk with each circumferential edge forming a sharp cutting knife. The slitter 32 is mounted on shaft 80 also carrying feed rolls 81 to positively grip the card and assist in moving it through the slitters. In order to provide an effective coaction between slitters 32 and 33, such as to slit the card cleanly, it is desirable that the cooperating and overlapping cutting

edges be in close, firm contact. Were both slitters 32 and 33 fixed against axial movement, then the slightest play or wear in their carrying shafts or bearings or in the slitters themselves would prevent the intimate contact between the slitters which is desired. Accordingly, lower slitter 33 is made in two similar, axially divided parts 33a and 33b, each firmly held by spring means in close contact with the cooperating side of upper slitter disk 32. Each of slitter parts 33a and 33b is rigid with a sleeve 85 from which pins 86 and a key 87 extend to be slidably received in openings in a collar 88 fixed to a common shaft 89. The pins 86 and key 87 slidably couple the slitter parts 33a and b to shaft 89 and at the same time connect the slitter parts to the shaft for rotation. Surrounding pins 88 are coil springs 90 which constantly urge sleeves 85 and the slitter parts 33a and b to slide along shaft 89 towards each other and into firm, intimate, invariable contact with the sides of slitter disk 32.

Shaft 89, as well as upper slitter shaft 80 is driven by a gear train 91 from the central gear 12.

The slitter parts 33a and 33b firmly support the card, during the slitting operation, in its own plane while the cutting edges of slitter 32 rotate to a point below the plane of the card to coact with parts 33a and b in shearing out the narrow strip S to divide the card into two. Due to the support of the card by parts 33a and b, the adjacent severed sides of the card sections are not bent downwardly by slitter 32 but remain perfectly flat. This is one reason for cutting out the narrow strip S to split the card C instead of merely slitting card C along a single dividing line which would result in one card having a bent edge.

The cards C which are slit into separate sections may be referred to as large, parent, or wide cards while the cards c which result from the slitting operation may be referred to as small, divisional, or narrow cards. The operation of cutting the cards C into cards c has been explained. When it is preferred to feed cards C through the machine without slitting them or when the small cards c are feeding through the machine, it is desirable to disable the card slitting means 32 and 33. In the case where small cards c are being fed, it is desirable to disable the slitters because if they remained in operative position, the slightest deviation of a card c from its normal line of travel would slice off a part of the card or bend its edge.

To disable the slitters, the lower slitter shaft 89 is moved transversely away from the upper slitter shaft 80. Accordingly, the lower slitter shaft is carried by rocker arms 92 pivoted on studs 93 carried by the frame. Straddling shaft 89 at each end is a forked arm 94 extending from a sleeve 95 which is freely rotatably carried by a shaft 96. Springs 97 connected to arms 94 urge the latter and the rocker arms 92 upwardly to operatively dispose the lower slitter with respect to the upper slitter.

On shaft 96 are fixed collars 98 each having one face in contact with a face of a sleeve 95. Projecting from said face of a collar 98 is a quadrant lug 99. In the path of lug 99, the sleeve 95 has a lug 100 of about 180° width (see Fig. 8.) Normally, lug 99 is close to one side of lug 100. When shaft 96 swings clockwise (as viewed in Fig. 8) through about 90°, then lug 99 engages the other side of lug 100 and begins to rock sleeve

95 clockwise with the shaft 96. Consequently, forked arm 94 integral with a sleeve 95 also rocks clockwise and because it straddles shaft 89 rocks the carrying arms 92 of the latter in the same direction about pivots 93. The result is that the lower slitter shaft 89 and its slitter parts will be moved downwardly away from the upper slitter and therefore out of cutting cooperation with the latter.

10 Shaft 96 is rocked by means of a crank arm 106 which is on the outside of the machine, accessible to the operator (see Fig. 7). When crank arm 106 is in full line position (Fig. 7), a latch pin or plunger 107 slidably mounted in handle 108 of the crank arm is held seated in a notch 109 of the frame by means of a spring 110. The latch pin is provided with a finger knob 111. To swing crank arm 106 clockwise (as viewed in Fig. 7), the operator first pulls knob 111 out, releasing latch plunger 107 from notch 109. The arm 106 can then be swung clockwise to dotted line position, Fig. 7. In this dotted line position, latch pin 107 seats in a notch 112 to hold the crank arm stationary. The swing from full line to dotted line position is about 25 95°.

As stated above, crank arm 106 is fixed to shaft 96 and therefore when the arm swings 95°, as explained, it will also rock shaft 96 and collars 98 at each end thereof clockwise through the same angle. For about the first 90° of this movement, lugs 99 on collars 98 do not contact lugs 100 on sleeves 95. Through about the last five degrees, the lugs 99 and 100 engage so that sleeves 95 are swung through substantially 5°, resulting in a substantially corresponding swing of lower slitter shaft 89 away from upper slitter shaft 80, thus separating the slitter 33 from 32 and rendering them incapable of cutting the cards.

40 When the lower slitter shaft 89 is moved to inoperative position, springs 90 which force the slitter parts 33a and b towards each other, if left free to act, would position these slitter parts so close to each other as to prevent proper return of the lower slitter to operative position. This is because the lower slitter parts would then engage and be stopped by the circumference of upper slitter disk. As a result, not only would the lower slitter parts fail to return to proper operating position with respect to the upper slitter disk but also the cutting edges of slitters 32 and 33 would be seriously damaged by the improper contact between them. Even if the lower slitter parts were not abruptly stopped by contact with the upper slitter disk but could be forced past the upper disk, the action would be injurious to the coacting cutting edges. To avoid these complications, the movement of the lower slitter shaft to disable the slitters is accompanied by a spreading apart of the slitter parts 33a and b, against resistance of springs 90, axially of shaft 80 to positions indicated in Fig. 11.

65 The axial separation of parts 33a and b is accomplished by the rocking of shaft 96 in the manner described. Referring to Fig. 10, shaft 96 is provided with a pair of radially projecting studs 115 initially located in the wide part of a heart-shaped slot 116. One-half the heart-shaped slot 116 is formed in a sleeve 117 and the complementary half of this slot is shaped in a similar sleeve 117, both rotatably carried by shaft 96. When shaft 96 has rocked about 45° in the direction in which it disables the lower slitter the studs 115 move down (as viewed in Fig. 10) into the tapering end of slot 116 and cam sleeves 117 apart.

This occurs before the shaft 96 moves the lower slitter shaft down. Forked arms 118 extend from sleeves 117, each fork of an arm being provided with a roller 119. The rollers of each arm 118 are located in a groove 120 of a sleeve 85 carrying one of the slitter parts. Accordingly, when pins 115 separate sleeves 117, arm 118 through the action of rollers 119 similarly separate the two halves of slitter 33, thereby moving the cutting edges of slitter parts 33a and 33b axially away from the cutting edges of upper slitter 32. Then, when the slitter parts 33a and b are swung transversely down, they are apart and cannot contact the cutting edges of disk 32 so that even during disabling of the cutters, no injury can result to the cutting edges.

When shaft 96 is returned to initial position to replace the lower slitter shaft 89 in operative position, the pins 115 do not leave the narrow portion of slot 116 in sleeves 117 until after shaft 89 has returned to operative position. Thus during return movement of slitter parts 33a and b to proper cutting alignment with slitter disk 32, the parts 33a and b are held apart and at a distance from the sides of disk 32 and injury to the cutting edges cannot occur.

After the parts 33a and b are in operative alignment, then pins 115 move into the wide part of slot 116 between sleeves 117 and permit springs 90 to force the parts 33a and b into intimate contact with the sides of cutting disk 32.

In order to prevent interference with the feed of large cards C or small cards c when the slitter is not in operation, the side locating fingers 47 are also disabled simultaneously with the slitter 33. This is effected when right hand sleeve 117 (as viewed in Fig. 10) moves to the right to move slitter part 33b in the same direction. Extending from the right hand sleeve 117 is an arm 122 (Figs. 6, 10, and 12) which when said sleeve 117 moves to the right engages one side of sleeve 67 to move the latter and the side locating device rigid therewith away from side stop 48. Thus, when depression 62 in disk 55 confronts follower 63 of the side locating device, spring 70 is unable to move the fingers 47 towards side stop 48. This is especially desirable when the small or divisional cards c are feeding abreast because in that case, action of fingers 47 if not restrained might kick the near divisional card onto the top of the farther divisional card and clog the feed passage.

It has been explained that one advantage of slitting the large card C into its divisional parts c by cutting out a strip S is that the adjacent edges of the divisional parts are not bent downwardly by the slitting operation.

Another advantage is that the divisional cards are less than half the width of the parent card. If each divisional card were exactly one half the width of the parent cards, it would be impossible to effectively feed two such stacks of divisional cards side by side or in double file through the machine. This is because the adjacent edges of the double file of cards would frictionally engage each other. Unless the rear edges of the cards abreast of each other were perfectly aligned in the hopper, one picker 21 would start moving its card before the other picker moved the other card, so that the latter card would be turned askew by the friction of its side edge with the adjacent edge of the card which moves first. The same thing might occur if in passing through the feed rolls, one card should be moved the slightest bit faster than the other because of a better frictional grip of its side of the feed rolls. As it is essential that

columns of the cards be in perfect alinement with the analyzing brushes, it is necessary to prevent the slightest possibility that a card might be moved transversely. For this reason, it is advantageous to divide the card C into small cards by cutting away a strip S, leaving each small card less than half the width of the large card. This further permits the use of a partition plate 125 (see Figs. 5, 16, and 17) in the supply hopper 22 which is of the width of strip S and divides the hopper into two separate compartments. In effect, the partition plate converts the single wide hopper into a double section hopper. The partition plate separates the two stacks of small cards c from each other (as may be seen from Fig. 5), preventing the adjacent side edges of the cards from interfering with the proper feed of either card.

In short, by cutting out the strip S in slitting card C into cards c, the advantage is gained of allowing for use of a partition plate in the hopper to separate two stacks of cards c from each other, thus permitting the proper and effective feeding of cards side by side and simultaneously through the machine. This saves time in gathering statistics from the cards c.

In accomplishing the above, it is necessary that each definitely numbered column of a small card c be analyzed by a sensing brush 28 assigned to that particular column and further that the relation of the brushes 28 to their columns be the same as when the large card C is being fed through the machine. That is column 1 of a card c should be sensed by the same analyzing brush 28 as column 1 of card C. The fixed relationship of the columns to the various brushes is necessary in order that the results obtained by means connected to the brushes be properly ascertainable. That is it is desired that a print record from columns 1 to 4 of a type bank should relate to columns 1 to 4 of the card c or C, whichever is feeding. It is therefore required to retain the same brush positions with respect to the columns of the small card as with respect to the large card columns. This object is also attained by the use of partition plate 125 which, being of the same width as strip S spaces the small cards and their respective columns exactly as the columns were spaced when they were part of the large card C, the brush positions being retained in the same relation to the columns, as indicated in Fig. 19.

Further, since cards c derived from a single card C are exact duplicates, in size and column position, either of such cards may be placed in either side of the hopper with its columns in alinement with the allotted brushes.

The partition plate 125 is also made use of for a controlling function related to the feeding of the small cards before the slitters 32 and 33 have been moved out of cooperation. When the slitters are in cooperation, the divisional cards c should not be fed because, as stated previously, their edges might be cut or bent by the slitter and locator fingers 47 might shove one card onto the card abreast. Referring to Fig. 16, contacts 126 secured to the bottom of hopper 22 are normally closed. These contacts are in the circuit which controls the running of the machine as will be more fully explained in connection with circuit diagram, Fig. 20. When full cards are being fed, the contacts 126 are closed. When divisional cards are to be fed, partition plate 125 is inserted in hopper 22. The plate has a depending lug 127 which when the plate is in

place, engages the lower contact carrier 128 and opens contacts 126. This opens the operating circuit of the machine. To close this circuit, contacts 129 (see Figs. 6, 7, and 20) are provided in parallel with contacts 126. Contacts 129 are normally open but when closed shunt contacts 126 to complete the machine operating circuit, as will be more fully explained in connection with the circuit diagram. Normally open contacts 129 are closed only when the slitters 32, 33 and locating fingers 47 have been disabled. As explained before, the slitters and side fingers are disabled by operation of crank handle 106. When the latter is swung to dotted line position (Fig. 7), portion 108 thereof engages the upper contact carrier 130 and closes contacts 129. With handle 106 latched in dotted line positions, contacts 129 are closed while the slitters and side locators are inoperative. The machine is then in condition for feeding the divisional cards c.

To retain partition plate 125 in position in the supply hopper 22, the latter has guideways 131 and 132 (see Figs. 5, 16, and 17) in which the plate is inserted and by which it is held in position against transverse movement. To retain the plate in the hopper, guideway 132 is open at its upper end to permit a hook 133 on the plate to project therethrough to the front of the hopper. A latch 134 slidably mounted on the front wall of the hopper is adapted to engage hook 133. A spring 135 normally retains latch 134 in operative latching position and it is necessary to grasp a knob 136 on the latch to move it against resistance of spring 135 in order to release the latch from hook 133 and permit removal of partition plate 125.

When the divisional cards c are being fed, it is first of all necessary to retain the same correlation of their columns to the sensing brushes 28. This, as already explained, is primarily made possible by making partition plate 125 of the same width as the cut-out S of the large card C. It is also necessary in feeding the small cards to the analyzing sections that they be not moved sidewise to disturb their proper positions with respect to the analyzing brushes. The card data perforations and the analyzing brushes are very narrow and the slightest misalignment of the card would prevent proper contact of the brushes with the perforations. When cards c are feeding abreast, there is normally no tendency once the cards emerge from the supply hopper of being laterally shifted by the action of feed rollers 24 and 25. But as one stack of cards c may be less in number than the other stack, after the smaller stack has been exhausted, cards continue to feed from the other stack.

The ordinary feed rollers would in the latter event exert uneven pressure on the surface of the card c feeding alone and move it askew or out of alignment with the brush positions. This can be understood from Fig. 3, showing the type of card feed rolls customarily used in statistical machines. The upper feed rolls A are a rigid unit and spring pressed at the ends to provide for yielding pressure on the card. So long as wide cards for which the feed rolls have been designed are feeding, there is an equal lifting of the upper feed rolls A and consequently an equal pressure along the card surface. But with a card c of less than normal width feeding, one side of upper rolls A will be lifted and the other side not. This inclines the upper rolls so that only a linear portion B of the card c is, in effect, engaged by a feed roll. The rest of the card

is not contacted by the upper feed rolls. Consequently, the tendency is to feed the left side of card c (as viewed in Fig. 3) faster than the right side of the card, which results in moving the card askew or transversely so that its columns will not be correlated to the assigned brush positions.

To prevent the above occurrence, upper feed rolls 25 are split or made in two similar sections axially aligned with each other, as shown in Fig. 2. As in previous practice, the farther ends of the rolls 25 are movably mounted in rocker arms 140 (see Fig. 1) and are resiliently urged towards the lower rolls 24 by springs 141. The upper rolls 25 depart from prior practice in being axially split into two sections. Each section terminates in a feed roll 25a which is hollow to rotatably receive a roller 142, each carried by the lower end of a block 143 slidably mounted on frame portion 144 (see Figs. 2, 4, and 14).

The slide blocks 143 are engaged by plungers 145 acted on by coil springs 146. The spring-pressed plungers thus constantly urge the inner ends of the split upper or outer feed rolls 25 towards the companion feed rolls 24. In above manner, the upper feed rolls are divided into two similar, axially separated, sections, each movable independently of the other section so that when one section is lifted by a small card c, the other is unaffected. Thus, even though a single file of small cards c were feeding through the machine, there would be no tendency of the feed rolls to be set at an inclined position and move the cards askew but each split section of the upper feed rolls would act independently of the other section to feed small cards. In brief, two separate, feed means are provided, side by side, to jointly feed large cards C or to independently feed small cards c, which may be passing through in double or single file.

Provision is also made for stopping the machine when the large cards C are exhausted to prevent unnecessary and idle running of the machine. For the same reason, operation of the machine should stop when the feed of small cards c stops. However, should one stack of small cards c be exhausted while the other is not, then provisions must be made for keeping the machine running until the latter stack is also exhausted. Only when both stacks of cards c are exhausted is the machine to stop running. The means for accomplishing the above objects will now be explained with reference to the circuit diagram, Fig. 20.

To start the machine, the operator depresses start key ST to close start key contacts st. With full cards C in the hopper 22, partition plate 125 is absent and normally closed hopper contacts 126 are operative. With contacts st and 126 closed, the following starting circuit is formed:

From + line 150, through stop key contacts sp (normally closed), contacts 126, clutch magnet 151, and through contacts st to - line 152.

Energization by above circuit of magnet 151 connects in a known manner a motor (not shown) to gear 10 (Fig. 1) from which the drive of the various parts of the machine is effected, as explained previously.

Energization of magnet 151 also closes contacts 151a. With these contacts and either of parallel contacts 154a or 155a closed, a shunt circuit is completed which by-passes the start key contacts st, permitting the operator to release the start key without interrupting operation of the machine. Contacts 151a are closed by clutch mag-

net 151, as already stated. Contacts 154a and 155a are closed under control of the cards. When cards C are feeding, both contacts 154a and 155a are closed. When a double file of cards c is feeding, the same thing is true. With only one file of cards c feeding, only one contact 154a or 155a is closed. With no cards C or c feeding, both contacts are open and the clutch magnet circuit is deenergized to cause cessation of operation of gear 10 by the motor drive.

Contacts 154a and 155a are respectively closed by energization of multi-contact relay magnets 154 and 155. To initially energize these magnets, cam contacts 156 and 156' must be closed in addition to normally closed contacts 157a and 158a. With both these contacts closed, the circuit through magnet 154 is from + line 150, through contacts 156, contacts 157a, and magnet 154 to - line 152 while the circuit through magnet 155 is from line 150, through contacts 156', contacts 158a, and magnet 155 to line 152.

Cam contacts 156 and 156' close simultaneously just before the card leaves the upper analyzing section and remain closed a short interval following the departure of the card from the latter analyzing section. Thus when the operator closes start key contacts st, he holds the start key down until the pickers 21 have fed the first card through and past the upper analyzing section. During this time, cam contacts 156 and 156' close, as above stated, and magnets 154 and 155 are energized. Energization of these magnets closes contacts 154a and 155a to complete the shunt path of the clutch magnet circuit, which path by-passes the start key contacts permitting the operator to release these contacts without interrupting machine operation.

Cam contacts 156 and 156' are closed only for a short interval of the card cycle. During the remainder of the card cycle, when contacts 156 and 156' open, provision is made for continuing energization of magnets 154 and 155. This is effected by providing a shunt circuit for these magnets which by-passes contacts 156' and 158a and a similar shunt circuit around contacts 156 and 157a. The shunt circuits include cam contacts 159 and 159' which close during the portion of the card cycle when cam contacts 156 and 156' are open. In series with contacts 159 are contacts 154b closed by magnet 154 and in series with contacts 159' are contacts 155b closed by magnet 155. Thus, the shunt circuit for magnet 154 is from line 150, through contacts 159, contacts 154b, and magnet 154, to line 152. The shunt circuit for magnet 155 is similarly through contacts 159' and 155b.

From the above, it is seen that magnets 154 and 155 must be energized to maintain contacts 154a and 155a closed to provide a shunt path around the start key contacts st. During the greater portion of the card cycle including the entire period during which the card is passing through the upper analyzing section, cam contacts 159 and 159' are closed to maintain magnets 154 and 155 energized. Cam contacts 159 and 159' open when the card has just left the upper analyzing section and close again after a brief gap before the next card reaches the upper analyzer. During this gap in the the card cycle, cam contacts 156 and 156' close to maintain the magnets energized. Contacts 156 and 156' are ineffective, however, unless normally closed contacts 157a and 158a remain closed during aforesaid gap in the cycle.

Contacts 157a and 158a are opened by energ-

zation of relays 157 and 158. As long as the latter relays are deenergized, contacts 157a and 158a stay closed and automatic operation of the machine continues. It may be stated here that as long as the cards continue to feed, these relays remain inactive. Hence, while cards are still feeding, contacts 157a and 158a are closed and during the portion of the cycle when cam contacts 156 and 156' close as well as for the remainder of the cycle, magnets 154 and 155 will be energized to close contacts 154a and 155a. In brief, while cards are feeding, the by-pass path shunting start key contacts st is closed and when the card feed has stopped to cause both contacts 154a and 155a to open, this by-pass is opened and the machine stops operating.

It is evident then that to continue automatic operation of the machine, relays 157 and 158 must not be energized during the card cycle. The circuits through these relays are similar and only one will be described. Considering relay 157, the circuit therethrough from line 150 to line 152 would be through relay 157, cam contacts 162, left hand upper brush 26, and contact roller 27 wiped by the brush in the absence of an intervening card.

Cam contacts 162 close only for a brief period while the card is between the brushes 26 and contact roller 27. There is a left hand brush 26 and a right hand brush 26, each engageable with a corresponding end strip of the card C which lies outside of the column sections of the card or the data-bearing portions thereof. These end strips are devoid of data perforations and may be termed blank, non-designating, or dead card portions.

Accordingly, during the whole interval when the card C is passing through the upper analyzing section, the two such brushes 26 are insulated by said dead card portions from contact roller 27. Hence, the circuit through relay 157 or 158 is not completed though contacts 162 close. However, if the feed of the cards has been exhausted, during the period in which a card should be beneath brushes 26, there will be no card there and contact roller 27 will be wiped by brushes 26. During this period, cam contacts 162 will close and the circuit through said relays will be established. This occurs during the card cycle prior to the closing of cam contacts 156 and 156'. The problem then is to have contacts 157a and 158a still open when contacts 156 and 156' later close so that the shunt path through magnet 154 and through magnet 155 will be broken. To accomplish this, magnet 157 when energized closes contacts 157b. This completes a holding circuit for the relay 157 which is as follows: From line 150, through relay 157, contacts 157b, and cam contacts 164 to line 152.

Cam contacts 164 close at the same time as cam contacts 162 but remain closed for a longer portion of the card cycle and until after contacts 156 and 156' open.

The continued energization of relay 157 holds contacts 157a open to prevent making of the by-path circuit through magnet 154 when contacts 156 close after contacts 159 have opened to break the other circuit path through magnet 154.

Magnet 154 is thus deenergized and contacts 154a open. In a similar manner magnet 155 is deenergized to open contacts 155a. The circuit paths through clutch magnet 151 which shunt start key contacts st are thus opened, resulting in deenergization of the clutch magnet to stop operation of the machine.

It has been previously explained how the small cards c are fed through the machine in the same line as though they were still parts of the large card C to thereby maintain the same brush positions with respect to the data columns. Another purpose of retaining the path of travel of a small card c the same as if it were part of the large card C is to maintain its dead end portion in the same relation to the end brushes 26. Hence with a double file of cards c passing through the upper analyzing section, both brushes 26 will be insulated from contact 27 by the dead end portions of the cards c abreast of each other and neither relay 157 nor 158 will be energized. With only a single file of small cards passing through the machine, only one brush 26 will be insulated from contact 27. The other brush will wipe the bare contact 27 and as a result either magnet 154 or 155 will be deenergized, depending on which side the cards c are still feeding.

Thus with a file of cards c passing through only the left side of the machine, magnet 154 alone will be energized while the right hand brush 26 will be making contact with roller 27 resulting in energizing magnet 158 to open contacts 158a and break the circuit through magnet 155. Energization of a magnet 154 or 155 will open one of contacts 154a or 155a but the other contact will remain closed so that the circuit to the clutch magnet will not be interrupted.

Only with the absence of cards c at both sides of the machine, will the opening of both contacts 154a and 155a result and deenergization of clutch magnet 151 take place.

The control of the accounting mechanism according to the information on the cards is effected by the lower analyzer section. Magnets 154 and 155 are also utilized to select the portion of the lower analyzing section which is to be effective for controlling the accounting mechanism when a single file of divisional cards c is feeding. As is well-known, the analyzing brush feels a perforation in the card column at a differential point in the card reading cycle and thereupon energizes a magnet which sets adding means in motion for the remainder of the card cycle. At the same time, a printing control magnet is energized to stop a type bar in a differential position corresponding to the controlling perforation in the card column.

For convenience of illustration, only one magnet to each card column is shown in Fig. 20. This magnet may represent the printing control magnet. The magnets are divided into two sets, the set M—L being correlated to the lower analyzer brushes 28 adapted to analyze cards c passing along the left hand side of the machine and the other set M—R being correlated to the brushes 28 adapted to analyze cards c passing through the right hand side of the machine.

When only a single file of cards c is feeding at one side of the machine, the brushes 28 adapted to sense a file of cards at the other side of the machine will wipe the bare contact roller 29 and accordingly energization would result of the set of magnets correlated to the latter brushes. This would cause useless operation of accumulators and would enter undesirable numbers into the latter. It would also cause undesirable printing on the record sheet which issues from the machine. To obviate the above objections, provision is made for rendering the

analyzer effective to energize only one set of magnets M—L or M—R when only a single file of cards c is feeding, magnets M—L being selected for energization by the analyzer when cards c are feeding through the left hand side and magnets M—R being selected when cards c are feeding through the right hand side of the machine. The selection is effected under control of the cards themselves. As explained previously in connection with the automatic machine operating circuit which by-passes the start key contacts, when cards c are passing along the left hand side of the machine, they cooperate with the left hand brush 26 of the upper analyzer section to control continued energization of magnet 154. Similarly cards c at the right hand side cooperate with the right hand brush 26 to maintain energization of magnet 155. When no cards c are passing through one side of the machine, the corresponding magnet 154 or 155 is deenergized. Thus, if a file of cards is feeding only on the left side, then magnet 154 is energized and magnet 155 is deenergized. These magnets control a plurality of contacts including contacts 154c and 155c, the former in series with the set of magnets M—L and the latter in series with magnets M—R.

To permit energization of a set of magnets, the contacts 154c or 155c must be closed. If cards are passing only on the left side of the machine, magnet 154 is energized and contacts 154c are closed while magnet 155 is deenergized and contacts 155c are open. Thus the magnets M—R cannot be energized although their correlated brushes 28 are wiping the bare contact roller 29. Magnets 154 and 155 also close parallel contacts 154d and 155d in the card reading and magnet circuit. With only magnet 154 energized, only contacts 154c and 154d are closed. When a perforation occurs in the card passing through the left side of the lower analyzer, the following circuit is completed.

From line 150, through contacts 154d, cam contacts 186 (closed during the card reading period), contact roller 29, the brush 28 engaging roller 29 through the perforation, a plug socket 167, plug connection 168, a plug socket 169, the magnet M—L connected to said plug socket, and through contacts 154c to line 152.

When only a single file of cards c is passing through the right side of the machine, then magnet 155 alone will be energized and contacts 154c and 154d will be open so that above circuit could not be made through a magnet M—L but contacts 155c and 155d would be closed so that a circuit similar to above could be made through a magnet M—R.

Briefly summarized, the machine operates as follows:

When feeding large cards C, the machine is usually conditioned for slitting them into divisional cards c after the analysis of the cards to control accounting operations. To condition the machine for slitting the cards, crank handle 106 (Figs. 6 and 7) is moved to the full line position (Fig. 7). The cards C are divided into two individual sections c by slitters 32 and 33 and the resulting divisional cards c delivered to the receiving magazine 30.

When feeding small cards c through the machine, the supply magazine 22 is separated into two compartments by a plate 125 (Figs. 5, 16, and 17). The plate opens contacts 126 and in order to start the machine, the operator is compelled to move crank handle 106 to the dotted

line position (Fig. 7) to disable the card slitting and locating mechanism and close contacts 129. These latter contacts permit the circuit of the clutch magnet 151 (Fig. 20) to be closed when the start key contacts st are manually closed. When the first card leaves the upper analyzing section, cam contacts 156 and 156' close to establish circuits through magnets 154 and 155 which thereupon close parallel contacts 154a and 155a. These latter and contacts 151a in series therewith by-pass the start key contacts and thereafter the machine operates automatically as long as cards c are feeding at either side of the machine.

When the feed of cards c is exhausted at one side of the machine, a brush 26 of the upper analyzer section makes contact with conductor 27 and at a period in the cycle which does not occur during the period of closure of cam contacts 156 or 156', magnet 157 or 158 is energized to open contacts 157a or 158a in series with said cam contacts. Then when contacts 156 and 156' close after the card reading period, the circuit through magnet 154 or 155 is not made and contacts 154c or 155c open, depending on whether the cards c along the left or right side of the machine have been exhausted. With contacts 154c open, circuits cannot be made through magnets M—L and with contacts 155c open, circuits cannot be made through magnets M—R. Thus a file of cards along one side of the machine selects correlated magnets and accounting apparatus for operation while a file of cards along the other side of the machine selects other magnets and accounting apparatus for operation.

The differential selection of the magnets in each set is made under control of the lower analyzer brushes 28 according to the reading of perforations in the cards and the previous passage of the cards through the upper analyzer determines whether the brushes correlated to one or the other or both sets of magnets M will be effective.

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 omissions 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:

1. In an accounting machine; a supply hopper containing a plurality of stacks of control cards and mechanism for feeding cards from said stacks singly or in plural files through the machine to control accounting operations, the cards when fed in plural files being in lateral alignment as they are being fed, said feeding mechanism including a feed roller split intermediate its ends into substantially aligned sections, each section being substantially of the width of a single file of such control cards, and resilient means for pressing each such section separately from the other into gripping contact with the card whereby the feed roller will exert an even feeding pressure on the surface of the cards regardless of whether single or plural files of cards are being advanced by the feeding means.

2. In an accounting machine having means to hold a plurality of stacks of cards; mechanism,

including means common to all the stacks of cards, for feeding cards from one or more of said stacks along separate, spaced paths through the machine to control accounting operations, a control means for causing the feeding mechanism to operate to feed cards from said stacks, a plurality of devices for detecting the presence or absence of cards in each of the separate paths, and means under control of said card detecting devices for rendering said control means effective to cause operation of the card feed mechanism only as long as said devices detect the presence of cards in at least one of said paths.

3. In an accounting machine having means to hold a plurality of stacks of cards; mechanism for feeding cards from one or more of said stacks along separate, spaced paths through the machine to control accounting operations, a control means comprising a circuit including switch means and a card feed clutch magnet for causing the feeding mechanism to operate to feed cards from said stacks, a plurality of devices for detecting the presence or absence of cards in each of the separate paths, and means under control of said card detecting devices for rendering said switch means effective to close said circuit, and thereby cause operation of the card feeding mechanism, only as long as said devices detect

the presence of cards in at least one of said paths.

4. In an accounting machine having means to hold a plurality of stacks of data bearing cards; a single feeding mechanism for feeding cards from one or more of said stacks along separate, spaced paths through the machine, analyzing means to which the cards along said paths are fed and including a common analyzing member for the cards of the different paths and analyzing portions coacting with said member and disposed along the separate paths, separate sets of accounting control elements, one set for the cards of each path, and controlled by the portion of the analyzing means for the cards of the related path in accordance with the data on the latter cards, controllers, one for each set of accounting control elements, to condition the latter for control by the related analyzing portion, a plurality of devices for detecting the presence or absence of cards in each of the separate paths, and means under control of said card detecting devices for selectively rendering said controllers ineffective upon the depletion of the cards of the related path and thereby preventing the analyzing means for the latter cards from controlling the set of accounting control elements related to the depleted cards.

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