

Sept. 10, 1940.

K. J. BRAUN

2,214,010

STATISTICAL CARD COMPARING MACHINE

Filed July 12, 1939

6 Sheets-Sheet 1

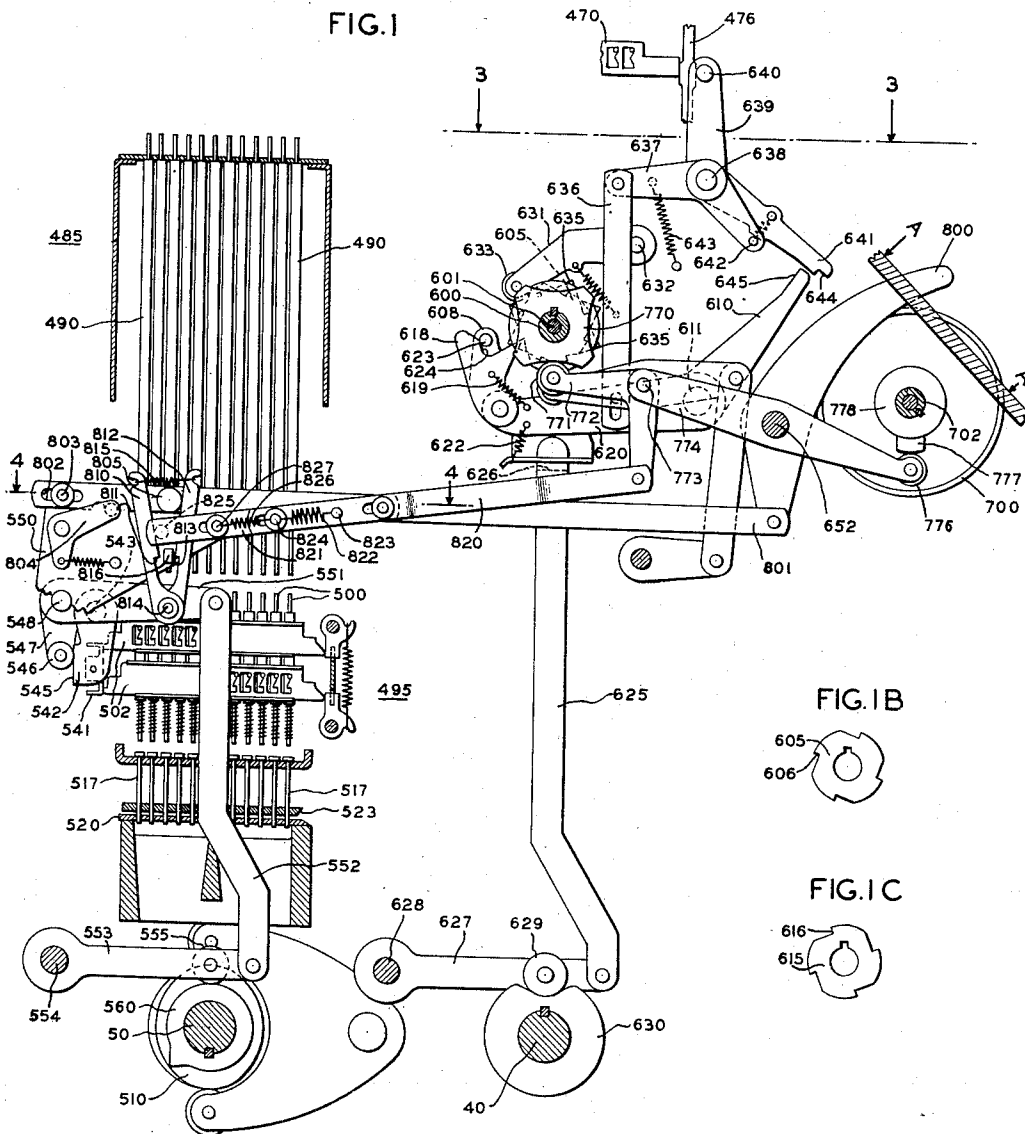


FIG. 1B

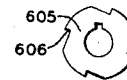
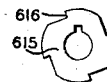


FIG. 1C



INVENTOR
KARL J. BRAUN

BY

H. A. Spark
ATTORNEY

Sept. 10, 1940.

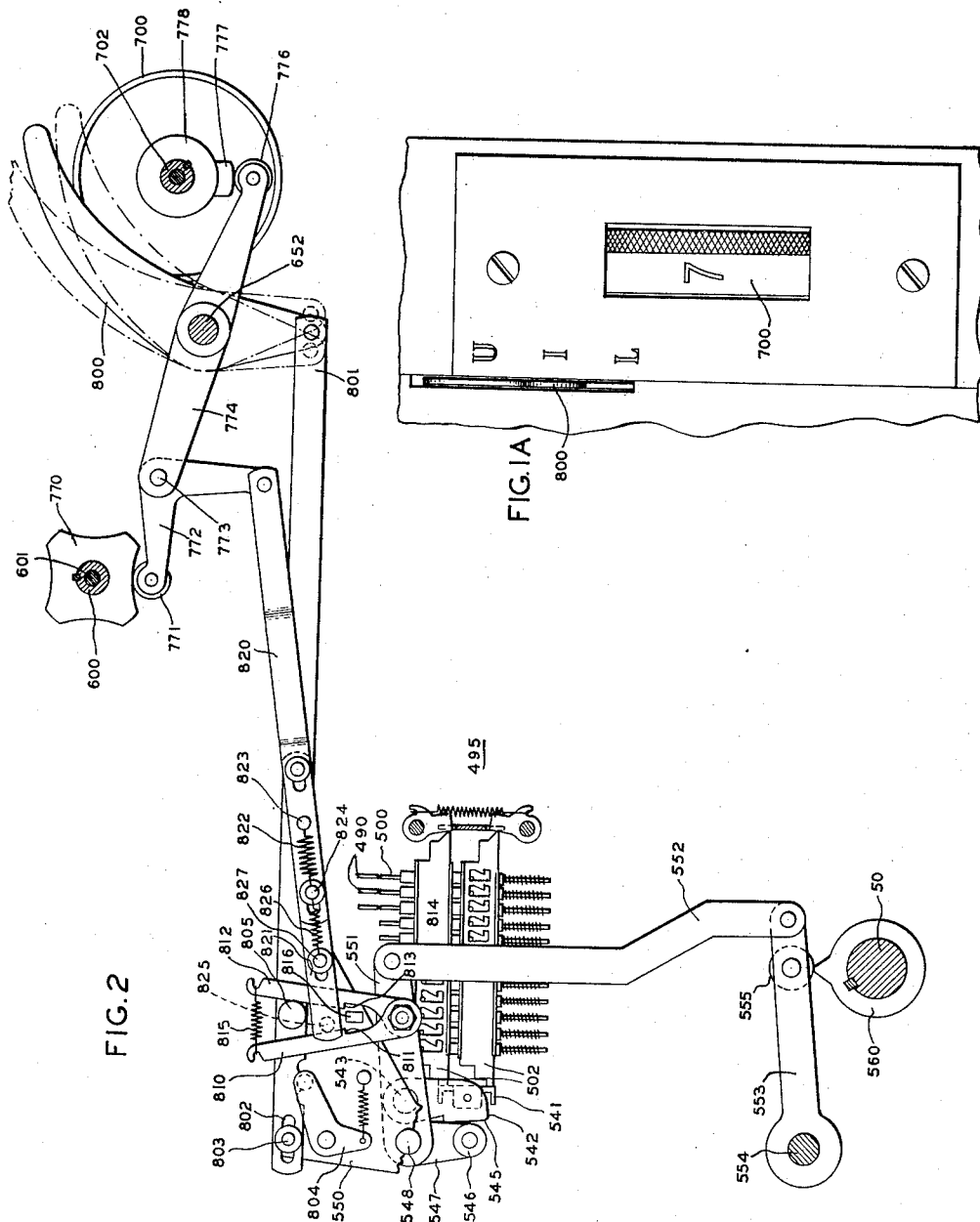
K. J. BRAUN

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Filed July 12, 1939

6 Sheets-Sheet 2



Sept. 10, 1940.

K. J. BRAUN

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STATISTICAL CARD COMPARING MACHINE

Filed July 12, 1939

6 Sheets-Sheet 3

FIG. 3

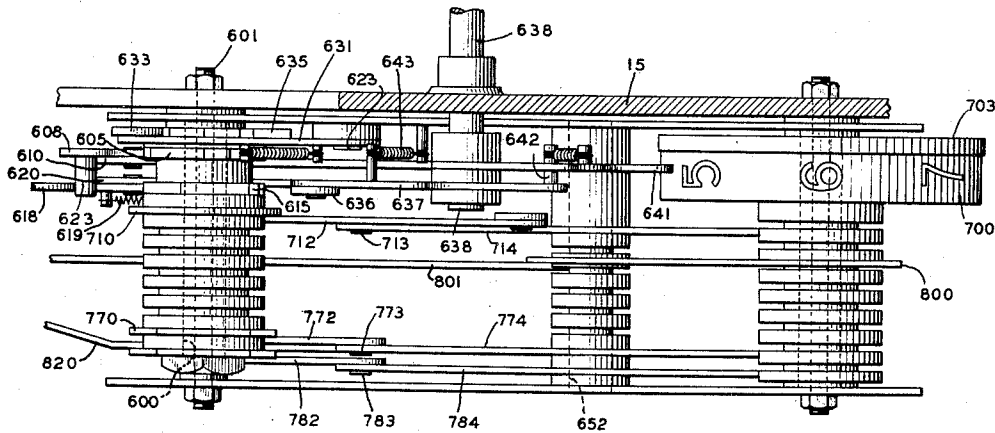
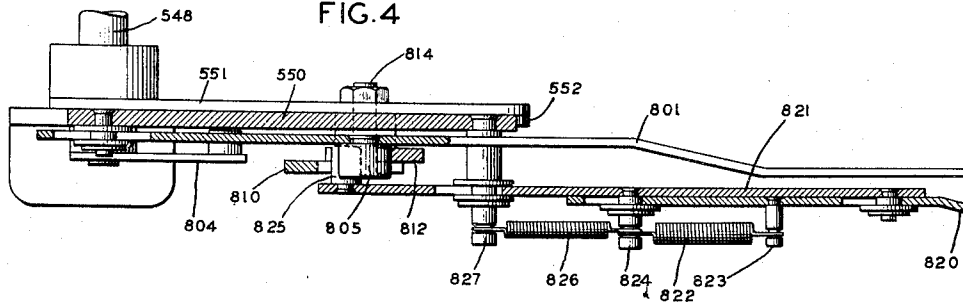


FIG. 4



INVENTOR
KARL J. BRAUN

BY *H. A. Spark*
ATTORNEY

Sept. 10, 1940.

K. J. BRAUN

2,214,010

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6 Sheets-Sheet 4

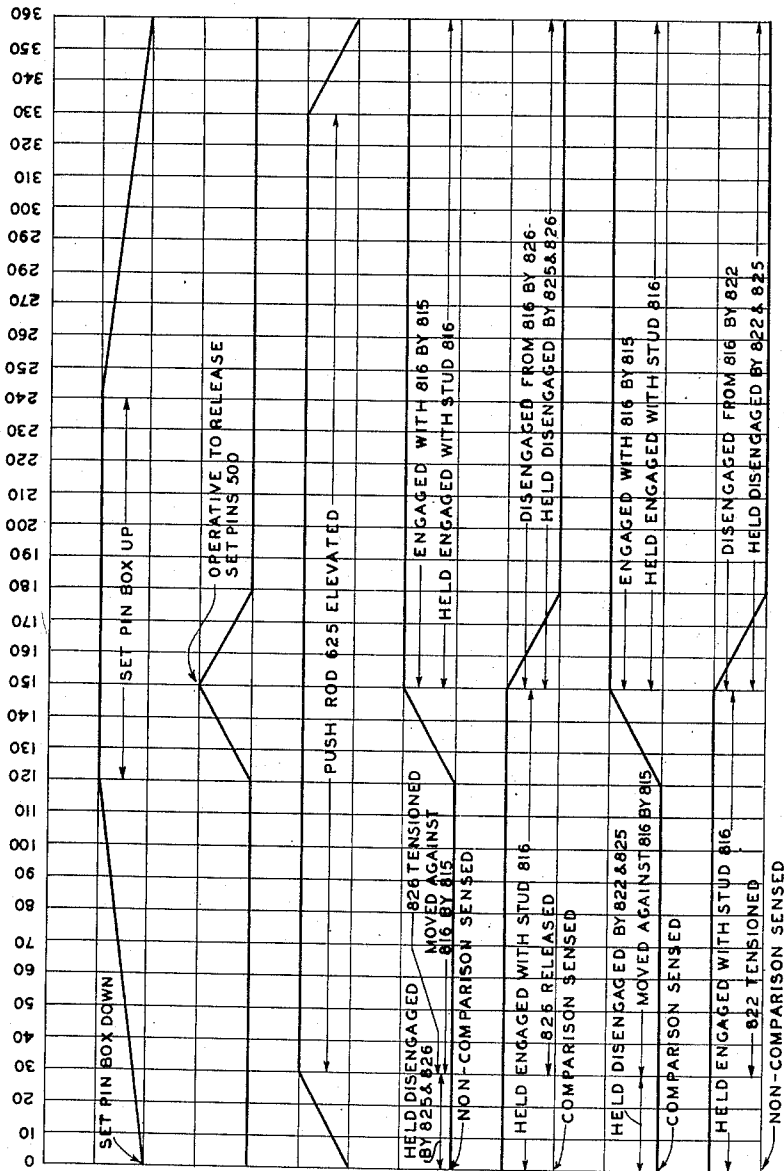


FIG. 5

PUNCH SET
PIN BOX
(CAM 510)

PUNCH SET
PIN RETRACT
(CAM 560)

CONTROL DEVICE
ACTUATING MECHANISM
(CAM 630)

LATCHING SHOULDER 810 -
ON CHANGE FROM COMP-
ARISON TO NON-COMPARISON

LATCHING SHOULDER 810 -
ON CHANGE FROM NON-
COMPARISON TO COMPARISON

LATCHING SHOULDER 812 -
ON CHANGE FROM NON-
COMPARISON TO COMPARISON

LATCHING SHOULDER 812 -
ON CHANGE FROM COMP-
ARISON TO NON-COMPARISON

INVENTOR
KARL J. BRAUN

BY *H. J. Spark*
ATTORNEY

Sept. 10, 1940.

K. J. BRAUN

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STATISTICAL CARD COMPARING MACHINE

Filed July 12, 1939

6 Sheets-Sheet 5

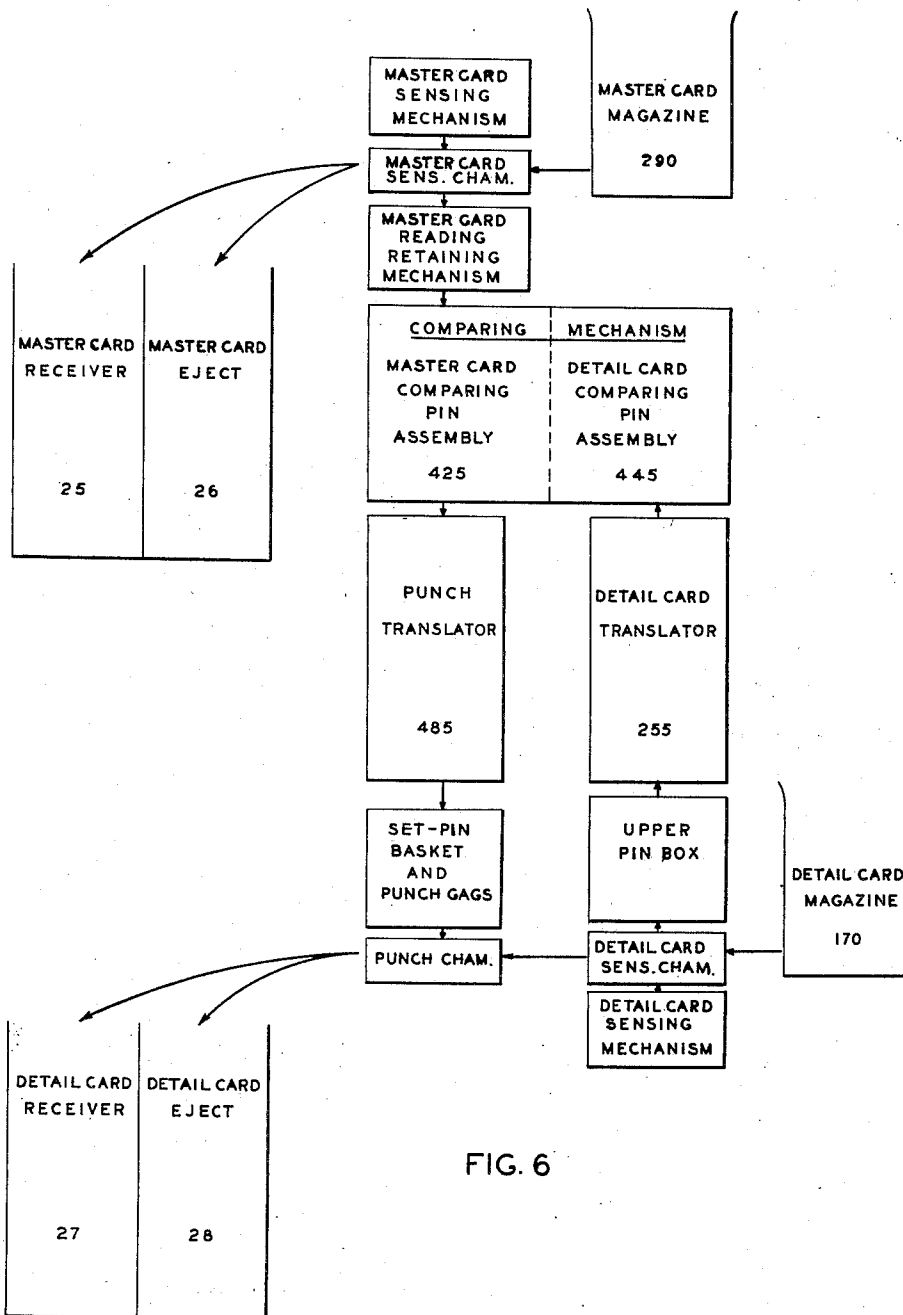


FIG. 6

INVENTOR
KARL J. BRAUN

BY

W. A. Sparks
ATTORNEY

Sept. 10, 1940.

K. J. BRAUN

2,214,010

STATISTICAL CARD COMPARING MACHINE

Filed July 12, 1939

6 Sheets-Sheet 6

FIG. 7

GROUPS OF OPERATIONS SELECTABLE AT SINGLE SETTING OF DIAL 700	TYPE OF OPERATION	CORRESPONDING OPERATION NUMBER IN FIG 74 OF PATENT NO. 2,214,094	SETTING OF PUNCH CONTROL LEVER 800	PUNCH TRANSLATOR	CONTROL CAMS EFFECTIVE IN ADDITION TO CARD FEED CAM AND PUNCH CONTROL CAM 770	OPERATION ON COMPARISON			OPERATION ON NON-COMPARISON		
						DEFLECTOR OPERATED	PUNCH RETRACT HELD EFFECTIVE	STOPPING MECHANISM OPERATED	DEFLECTOR OPERATED	PUNCH RETRACT HELD EFFECTIVE	STOPPING MECHANISM OPERATED
A	SORTING	1	X	OUT	780				X		
	SORTING & PUNCHING	7	U	IN	780				X	X	
	SORTING & PUNCHING	9	L	IN	780		X		X		
	SORTING (WITH PUNCHING)	27	I	IN	780				X		
B	SORTING	2	X	OUT	(780)	X					
	SORTING & PUNCHING	8	U	IN	(780)	X				X	
	SORTING & PUNCHING	10	L	IN	(780)	X	X				
	SORTING (WITH PUNCHING)	28	I	IN	(780)	X					
C	STOPPING MACHINE	5	X	OUT	760						X
	STOPPING & PUNCHING	15	U	IN	760				X	X	
	STOPPING & PUNCHING	17	L	IN	760		X				X
	STOPPING MACHINE (WITH PUNCHING)	29	I	IN	760						X
D	STOPPING MACHINE	6	X	OUT	(760)			X			
	STOPPING & PUNCHING	16	U	IN	(760)			X		X	
	STOPPING & PUNCHING	18	L	IN	(760)		X	X			
	STOPPING MACHINE (WITH PUNCHING)	30	I	IN	(760)			X			
E	SORTING & STOPPING	11	X	OUT	780 & 760				X		X
	SORTING, STOPPING & PUNCHING	19	U	IN	780 & 760				X	X	X
	SORTING, STOPPING & PUNCHING	20	L	IN	780 & 760		X		X		X
	SORTING & STOPPING (WITH PUNCHING)	31	I	IN	780 & 760				X		X
F	SORTING & STOPPING	12	X	CUT	780 & (760)			X	X		
	SORTING, STOPPING & PUNCHING	21	U	IN	780 & (760)			X	X	X	
	SORTING, STOPPING & PUNCHING	22	L	IN	780 & (760)		X	X	X		
	SORTING & STOPPING (WITH PUNCHING)	32	I	IN	780 & (760)			X	X		
G	SORTING & STOPPING	13	X	OUT	(780) & 760	X					X
	SORTING, STOPPING & PUNCHING	23	U	IN	(780) & 760	X				X	X
	SORTING, STOPPING & PUNCHING	24	L	IN	(780) & 760	X	X				X
	SORTING & STOPPING (WITH PUNCHING)	33	I	IN	(780) & 760	X					X
H	SORTING & STOPPING	14	X	OUT	(780) & (760)	X		X			
	SORTING, STOPPING & PUNCHING	25	U	IN	(780) & (760)	X		X		X	
	SORTING, STOPPING & PUNCHING	26	L	IN	(780) & (760)	X	X	X			
	SORTING & STOPPING (WITH PUNCHING)	34	I	IN	(780) & (760)	X		X			
I	PUNCHING	3	U	IN	NONE					X	
	PUNCHING	4	L	IN	NONE		X				
	PUNCHING	35	I	IN	NONE						

INVENTOR
KARL J. BRAUN

BY *D. A. Sparks*
ATTORNEY

UNITED STATES PATENT OFFICE

2,214,010

STATISTICAL CARD COMPARING MACHINE

Karl J. Braun, North Merrick, N. Y., assignor to
Remington Rand Inc., Buffalo, N. Y., a corpora-
tion of Delaware

Application July 12, 1939, Serial No. 284,075

6 Claims. (Cl. 164—114)

This invention relates to machines for comparing perforation patterns in different records, and, particularly, to means for variably controlling the punching of additional perforations in selected records, as the result of the comparison, or non-comparison, of the compared perforation patterns.

An embodiment of the invention is shown herein as applied to a Statistical card comparing machine, such as that disclosed in the co-pending application of Karl J. Braun, S. N. 228,381, filed September 3, 1938, now Patent No. 2,211,094, dated August 13, 1940. Machines of the type shown in said patent are used in accounting or statistical systems in which master records are used in conjunction with detail records. In these systems, it is desirable to compare pre-punched designative data contained in detail records with corresponding pre-punched data in the master records, and to control or effect various other operations in connection with such records in accordance with the comparison, or non-comparison, of the pre-punched data.

In the machine disclosed in the cited patent, either of three types of operations can be performed, namely,

1. Record sorting,
2. Record punching, or
3. Stopping the machine (e. g., to permit the insertion of control records at desired points in the run of compared records).

Each of these operations may be effected selectively or in combination with either or both of the others upon the sensing of a comparison, or non-comparison, between designative perforation patterns in master and detail records, according to the requirements of a particular accounting or statistical problem. The machine is also provided with variably controllable master and detail record feeding mechanisms whereby any one of a plurality of different types of master and/or detail record feeding may be effected, according to the quantitative relationship of the master and detail records to be handled in a particular problem, in conjunction with any desired combination of the above mentioned sorting, punching and stopping operations. Furthermore, an operation selector mechanism is provided whereby a given machine may be preconditioned, in accordance with the several individual types of record handling problems that may arise in a given accounting or statistical system, to effect selectively any one of a plurality of the various available combinational operations of record sorting,

and/or record punching, and/or machine stopping, and record feeding. In the particular arrangement shown in the cited patent, the operation selector mechanism is controlled by an operation selector dial, manually settable to eight positions, whereby a statistical card comparing machine may be arranged to effect any one of eight of such combinational operations selectively.

The present invention provides, as its principal object, an improved form of operation selector mechanism whereby the number of different combinational operations that may be performed on a given machine may be substantially increased.

Another object of the invention is to provide improved means for controlling record punching in such machines in accordance with the sensing of a comparison, or non-comparison, between designative perforation patterns in master and detail records.

A preferred form of the invention is disclosed in the appended drawings, in which,

Fig. 1 is a conventionalized left side elevation of the invention, in conjunction with the elements of a statistical card comparing machine that cooperate therewith, showing the relative positions of the several elements when the machine is in normal or stopping position;

Fig. 1A is a view taken along the line A—A of Fig. 1 showing the relative positions of the operation selector dial and the punch control lever;

Fig. 1B is a detail of the inner ratchet of the control device actuating mechanism;

Fig. 1C is a detail of the outer ratchet of the control device actuating mechanism;

Fig. 2 is an enlarged elevation of a portion of the mechanism of Fig. 1, showing the several elements in operated position at the time the locking slides for the punch set pins are fully retracted;

Fig. 3 is a plan view of the operation selector mechanism, taken substantially along the line 3—3 of Fig. 1;

Fig. 4 is a plan view of a portion of the control mechanism for the punch set pin retract mechanism, taken substantially along the line 4—4 of Fig. 1;

Fig. 5 is a timing diagram;

Fig. 6 is a schematic illustration of the principal elements of a statistical card comparing machine of the type disclosed in the above mentioned patent; and

Fig. 7 is a chart illustrating the various groups of combinational card handling operations that

may be effected by a statistical card comparing machine, equipped with the present invention, at a single setting of the operation selector dial.

To facilitate an understanding of the present invention, a brief description of a statistical card comparing machine of the type disclosed in the above mentioned patent, with which the invention is particularly adapted to function, is included hereinafter. For a detailed description of such machine, reference may be had to said patent.

STATISTICAL CARD COMPARING MACHINE—BASIC MECHANISM

In machines of the type disclosed in the cited patent, detail cards are placed in a detail card magazine 170 (see Fig. 6) and are passed seriatim to suitable feed rolls whereby they are conveyed, first, to the detail card sensing chamber in which their perforated data is analyzed, and second, to a punch chamber in which additional data may be perforated in the cards. From the punch chamber, the detail cards are conveyed either to a "receiver" pocket 27 or to an "eject" pocket 28, depending on the setting of the card sorting control mechanism and the character of the designative data in the cards. During the period in which a detail card is held in the detail card sensing chamber, the perforation pattern therein is sensed by pins in a reciprocating detail card sensing mechanism whereby a mechanical representation of such perforation pattern is transmitted, by means of pins in an upper pin box and translator wires in a translator 255, to the detail card comparing pin assembly 445 of the comparing mechanism.

The master cards are placed in a master card magazine 290 and are passed seriatim to suitable feed rolls whereby they are conveyed to the master card sensing chamber in which their perforated data is analyzed. From the master card sensing chamber, the master cards are conveyed either to a "receiver" pocket 25 or to an "eject" pocket 26, depending on the setting of the card sorting control mechanism and the character of the designative data in the cards. During the period in which a master card is held in the master card sensing chamber, the perforation pattern contained therein is sensed by pins in a reciprocating master card sensing mechanism whereby a mechanical representation of such perforation pattern is transmitted to pins in a master card reading retaining mechanism wherein it is retained, by suitable locking mechanism, until a new master card is sensed. The movement of the pins in the reading retaining mechanism is transmitted directly to the master card comparing pin assembly 425 of the comparing mechanism.

Comparing mechanism

In the comparing mechanism, the mechanical representations of perforation patterns in simultaneously sensed master and detail cards are mechanically compared, and the occurrence of a comparison, or non-comparison, between such perforation patterns is utilized to control or vary machine operations. A knowledge of the specific construction and manner of operation of the comparing mechanism is not essential to an understanding of the present invention, but may be obtained from the cited patent. Insofar as the present invention is concerned, it is sufficient to understand that the movement of the pins in the master and detail card comparing pin as-

semblies 425 and 445, in accordance with the perforation patterns in master and detail cards, is effective to determine the position of certain comparing slides 470, one of which is partially illustrated in Fig. 1. The construction and arrangement of the comparing mechanism is such that in the event the compared perforation patterns are identical, the slides 470 are free to move to the left to permit leftward movement of a comparing slide sensing bail rod 640 as in Fig. 1, whereas, if either pattern contains a perforation for which there is no counterpart in the other, one or more of the slides 470 are blocked and serve to prevent the leftward movement of bail rod 640. The manner in which bail rod 640 is operated to sense the position of comparing slides 470 is described hereinafter under the heading Control device—actuating mechanism.

Punch mechanism

In order to effect the transfer of all or part of the master card perforation patterns to detail cards, means are provided to pass each detail card through a punch mechanism, settable under control of the master cards, wherein such transferring operation may be effected. The punch mechanism employed herein is identical to that in the cited patent but is provided with an improved control mechanism, hereinafter described, whereby punching may be effected selectively in accordance with the comparison, or non-comparison between perforation patterns in master and detail cards.

Essentially, the punch mechanism includes a punch translator for transmitting mechanical representations of master card perforation patterns; a reciprocable set pin box, including set pins for sensing and retaining the mechanical representations of perforation patterns so transmitted, and punch gags for perforating detail cards in accordance with the setting of the set pins; a retract mechanism to cancel or erase the setting of the set pins; and a punch chamber in which the detail cards are retained during punching operations.

In order to transmit mechanical representations of master card perforation patterns from the master card sensing mechanism to the punch set pins, a removable punch translator 485 (Figs. 1 and 6) provided, with a plurality of rows of translator wires 490, is arranged beneath the master card comparing pin assembly 425. By this arrangement the depression of any pin in the master card comparing pin assembly, under control of a sensing pin in the master card sensing mechanism, results in the depression of the corresponding translator wire 490. Thus, in each machine cycle a mechanical representation of a master card perforation pattern is registered by depressed translator wires 490, and, due to the arrangement of the locking mechanism for the pins in the reading retaining mechanism, such registration is retained until the succeeding master card is sensed.

Mounted beneath punch translator 485 (Figs. 1 and 6) is a reciprocable set pin box 495 provided with a plurality of rows of spring urged set pins 500 which, when depressed, may be locked in their lower positions by spring urged locking slides 502. During the first half of each machine cycle, set pin box 495 is moved upwardly (see also Fig. 5), by complementary cams 510 keyed to a cam shaft 50, to force set pins 500 against all translator wires 490 that are held depressed in accordance with the perforation pat-

CONTROL DEVICE—ACTUATING MECHANISM

terms set up in the master card reading retaining mechanism. The extent of such movement is sufficient to permit the locking of any depressed set pin 500 by its associated locking slide 502. Thus, during the mid-portion of the machine cycle following that in which a master card is sensed, the mechanical representation of the master card perforation pattern, registered by depressed translator wires 490, is transferred to set pins 500. During the interval that set pin box 495 is elevated, the detail card that was sensed in the preceding cycle is passed into the punch chamber, which comprises an upper stripper plate 523 and a lower die plate 520. During the latter part of each machine cycle, set pin box 495 is moved downwardly by cams 510 and the locked set pins 500 are effective to force the associated punch gags 517 through the detail card, now in the punch chamber, whereby the perforation pattern contained in the master card is reproduced in the detail card.

To prevent error in the reproduction of perforation patterns, set pin box 495 is provided with means to retract the set-up made by the preceding master card during the time a new master card set-up is made. For this purpose, a retract bail bar 541 (Figs. 1 and 2), arranged to coact with the rearward ends of all locking slides 502, is pivotally supported by a pair of arms 542 fast on a rock shaft 543 suitably journaled in the machine. A vertical face 545 on the rearward edge of each arm 542 is arranged, during the entire vertical movement of set pin box 495, to ride against a roller 546 on an arm 547 fast to a transverse rock shaft 548 journaled in a bracket 550. Fixed to the left end of shaft 548 is an arm 551 connected, by a link 552, to an arm 553 which is pivoted at 554 and provided with a follower roller 555 that coacts with a cam 560 keyed to cam shaft 50. The arrangement of the punch set pin retract mechanism is such that immediately after set pin box 495 reaches its highest position (see also Fig. 5), cam 560 is effective momentarily to shift bail bar 541 and all locking slides 502 to the right, against the tension of their springs, to release all previously depressed set pins 500. In the event the new perforation pattern does not contain corresponding perforations, all previously depressed pins 500 are restored to their upper positions by their springs; whereas, all set pins 500 that correspond to the new perforation pattern are held in their lower positions by depressed translator wires 490, and are locked in such position by the return of locking slides 502 after follower roller 555 rides off the high dwell of cam 560.

Control device

As completely disclosed in the above cited patent, each of the mechanisms, for effecting or varying machine functions such as card feeding, sorting, punching, and stopping the machine, as the result of the sensing of a comparison, or non-comparison, in the perforation patterns of master and detail cards, are actuated by individual control cams which may be rendered effective either singly or in combination, as desired, and are arranged for step-by-step operation by common actuating mechanism under control of the comparing mechanism. For convenience, the several control cams and their associated mechanisms, the manually settable means for rendering the control cams effective, and the control cam actuating mechanism, are referred to as the Control device.

Each of the several control cams employed in a machine of this type is secured to a sleeve 600 (Figs. 1, 2, and 3) rotatably mounted on a stud 601 mounted on the frame of the machine. Each of the control cams is arranged to control its associated mechanism in one manner when the perforation patterns in simultaneously sensed master and detail cards compare, and in a different manner when such perforation patterns do not compare. Therefore, the control cams are arranged to be actuated to effect their respective functions whenever a non-comparison is sensed after a cycle in which a comparison was sensed and, also, whenever a comparison is sensed after a cycle in which a non-comparison was sensed. To effect the requisite movement of the control cams, an actuating mechanism, operable under control of the comparing mechanism, is provided to cause recurrent step-by-step movement of sleeve 600. This mechanism comprises an inner ratchet 605 (see Fig. 1B) and an outer ratchet 615 (see Fig. 1C), each provided with four equally spaced teeth 606 and 616, respectively, and having blank spaces, equivalent to a tooth space, between adjacent teeth. Both ratchets are fast to sleeve 600 but are offset relative to each other so that teeth 616 of ratchet 615 are intermediate to teeth 606 of ratchet 605 whereby, in effect, they form an eight toothed ratchet. Coacting with ratchet 605 is an actuating pawl 608, urged clockwise by a light spring (not shown), carried by the horizontal arm of a lever 610 which is pivoted on a frame stud 611 and is urged counter-clockwise by a spring (not shown). Coacting with ratchet 615 is an actuating pawl 618, urged clockwise by a spring 619, carried by a lever 620 which is also pivoted on stud 611 and is urged counter-clockwise by a spring 622. The arrangement of ratchets 605, 615, and pawls 608, 618 is such that during machine cycles following those in which a comparison is sensed, pawl 608 registers with a blank space on ratchet 605, whereas, pawl 618 is adapted to register with a tooth 616 on ratchet 615. However, when levers 610 and 620 are in their lowermost positions, a stud 623 on pawl 608 coacts with a cam surface 624 on pawl 618 whereby pawl 618 is moved counter-clockwise against the tension of spring 619 to prevent the engagement of the pawl with a tooth 616.

For operating pawls 608 and 618, an offset push rod 625, provided at its upper end with an abutment 626 arranged to coact with levers 610 and 620, is connected to an arm 627 pivoted at 628 and provided with a follower roller 629 coacting with a cam 630 keyed to front cam shaft 40. The arrangement of cam 630 (see also Fig. 5) is such that levers 610 and 620 are held in their uppermost position by push rod 625 and abutment 626 during the greater part of each cycle, but are urged downwardly by their springs at approximately 30° before the end of the cycle, and reach their lowermost positions at the end of the cycle. Thus, during the early part of each cycle, push rod 625 is elevated and, in the event either pawl 608 or 618 has engaged a tooth 606 or 616, respectively, is effective to actuate sleeve 600 through one-eighth of a revolution. However, in the event pawls 608 or 618 are not engaged with ratchets 605 or 615, respectively, levers 610 and 620 are operated idly and no movement is imparted to sleeve 600. A spring urged detent arm 631, pivoted at 632 and having a roller 633 arranged to coact with a detent plate 635 fast on sleeve 600, 75

is provided to center sleeve 600 in each of its several positions.

In order to effect an actuation of sleeve 600 whenever there is a non-comparison between master and detail card perforation patterns in a cycle following one in which there was a comparison, and vice versa, means are provided to sense the positions of comparing slides 470 of the comparing mechanism during each cycle, and to control actuating pawls 605 and 615 accordingly. For this purpose, a vertical link 636 is joined by a pin-in-slot connection to lever 620 and is connected at its upper end to the horizontal arm of a bell-crank 637 pivotally mounted on a transverse rock shaft 638. Secured to shaft 638 is a pair of arms 639 supporting a bail rod 640 which is adapted, through manually settable interponents 476, to sense the position of comparing slides 470. Also fast on rock shaft 638 is an oblique arm 641 which is spring urged into engagement with a limit stud 642 on the pendant arm of bell-crank 637, and is provided with a cutaway shoulder 644 arranged to engage a latch face 645 on the upwardly extending arm of lever 610. The entire assembly comprising shaft 638, bell-crank 637, and arms 639 and 641 is urged counter-clockwise by a comparatively strong spring 643, extended between the horizontal arm of the bell-crank and a frame stud.

At the beginning of each cycle, cam 630 elevates push rod 625 and, through lever 620, link 636, bell-crank 637, and arm 641, rocks shaft 638 clockwise to move bail rod 640 out of engagement with interponents 476. Toward the end of each cycle, shortly after comparing slides 470 are positioned, follower roller 629 rides into the low dwell of cam 630, thereby lowering lever 620 and link 636, and thereby permitting spring 643 to urge bell-crank 637 and shaft 638 counter-clockwise. In the event all comparing slides 470 in the columns containing designative data are free to move leftwardly, as in the case when the compared perforation patterns in master and detail cards are identical, bail rod 640 is free to move leftwardly, whereby shaft 638 rocks counter-clockwise and withdraws shoulder 644 on arm 641 from the path of movement of latch face 645 as lever 610 is rocked counter-clockwise. In this case, when levers 610 and 620 rock to their lowermost positions, pawl 608 rides on a blank space of ratchet 605, and stud 623 coacts with cam face 624 to prevent the engagement of pawl 618 with ratchet 615. Thus, when a cycle in which a comparison is sensed follows a cycle in which a comparison was sensed, no movement is imparted to sleeve 600, and the control cams thereon function in the same manner as in the preceding cycle. However, in the event one or more comparing slides 470 are held in their extreme rightward positions when shaft 638 is urged counter-clockwise, as in the case when the perforation patterns in master and detail cards are not identical, bail rod 640 is prevented from moving leftwardly, whereby shaft 638 is held in rocked position and retains shoulder 644 on arm 641 in the path of movement of latch face 645. In this case, lever 610 is held in its uppermost position as lever 620 descends. Thus, stud 623 is ineffective to prevent the engagement of pawl 618, whereby spring 619 engages pawl 618 with a tooth 616 on ratchet 615 when lever 620 reaches its lowermost position. Immediately thereafter, push rod 625 is again elevated to actuate lever 620 and pawl 618 which, in turn, actuate sleeve 600. Thus, when a cycle in which a non-comparison

is sensed follows a cycle in which a comparison was sensed, sleeve 600 is rotated through one step by lever 620, and the several control cams thereon are positioned to control their associated mechanisms accordingly.

In the event another non-comparison is sensed at the end of the succeeding cycle, lever 610 is retained in its uppermost position, as above. In this case, since pawl 618 is now in register with a blank space on ratchet 615, lever 620 moves idly and no further movement is imparted to sleeve 600. This condition is maintained as long as the perforation patterns in simultaneously sensed master and detail cards do not compare. However, when the next comparison is sensed, bail rod 640 and shaft 638 are free to rock counter-clockwise, and serve to disengage shoulder 644 from latch face 645 to permit lever 610 to follow push rod 625 downwardly. In this case, since pawl 608 is now in register with a tooth 606 on ratchet 605, the subsequent elevation of push rod 625 is effective to actuate sleeve 600. Thus, when a cycle in which a comparison is sensed follows a cycle in which a non-comparison was sensed, sleeve 600 is rotated through one step by lever 610, and the several control cams thereon are positioned to control their associated mechanisms accordingly.

Punch retract control mechanism

In punched card systems involving the comparison between designative perforation patterns in master and detail cards, it is frequently desirable that additional data be transferred from the master cards to the detail cards. As heretofore stated, a statistical card comparing machine of the type disclosed in the cited patent comprises a punch mechanism, settable in accordance with the perforation patterns in master cards, whereby one or more columns of information in a master card may be transferred to one or more detail cards. In addition, the patent discloses a control mechanism for the punch set pin retract mechanism whereby the machine may be set to

1. Punch additional data in comparing detail cards and prevent punching of additional data in non-comparing detail cards, or
2. Punch additional data in non-comparing detail cards and prevent punching of additional data in comparing detail cards.

To effect the first of these operations, it is necessary, as shown in Fig. 66 of the patent, to place a control cam 770 on sleeve 600, and to provide a linkage for the punch retract mechanism, operable thereby. Then, said cam 770, when manually rendered effective at a given setting of the operation selector dial, is operative under control of the comparing mechanism to prevent punching in non-comparing detail cards, and to permit punching in comparing cards. In the event that a particular accounting system also requires that the second of these operations be performed, it is necessary to place a second control cam 770, offset 45° from the first mentioned control cam, on sleeve 600, and to provide a separate linkage for the punch retract mechanism, operable thereby. Then, the second control cam, when manually rendered effective at a different setting of the operation selector dial, is operative under control of the comparing mechanism to prevent punching in comparing detail cards, and to permit punching in non-comparing cards. Thus, if an accounting system requires that both of the above mentioned operations be performed, a

statistical card comparing machine for doing this work, having a control mechanism of the type disclosed in the cited patent, must be provided with two punch retract control cams and their associated linkages, and, further, a different dial position on the operation selector dial is required for each card handling operation, involving card punching, that is to be performed.

To eliminate this duplication of elements and to permit a greater selection of different card handling operations under control of the operation selector dial, the present invention provides means operable by a single control cam for controlling the operation of the punch set pin retract mechanism, whereby punching may be prevented when a comparison or a non-comparison occurs, as desired, and, further, provides an individual, manually settable control to permit the selection of any desired type of punching operation by itself, or in conjunction with any combinational operation or sorting and/or stopping that may be selected by the operation selector dial.

As described hereinabove, the set pin box in the punch mechanism is adapted to reciprocate during each machine cycle, and is arranged, during the mid-portion of each cycle, to sense and retain a mechanical representation of the master card perforation pattern registered by depressed punch translator wires, and to transfer such perforation pattern to a detail card at the end of the cycle. If it is desired to prevent the transfer of a perforation pattern to a non-comparing detail card, means must be provided to prevent the retention of the perforation pattern in the set pin box when a non-comparison is sensed. Further, if it is desired to prevent the transfer of a perforation pattern to a comparing detail card, means must be provided to prevent the retention of the perforation pattern when a comparison is sensed.

To prevent the retention of perforation patterns under the conditions stated, the invention provides two arms 810 and 812 (Fig. 1) pivotally mounted on a stud 814 on arm 551 of the punch set pin retract mechanism. Arms 810 and 812 are urged together by a light spring 815, and each is provided with a latching shoulder 811, 813, respectively, capable of engaging a square stud 816 secured to bracket 550. The arrangement is such that when arm 551 is rocked under control of cam 560 near the mid-point of a cycle, to cause the retraction of locking slides 502 (as in Fig. 2), arms 810 and 812 are raised sufficiently so that either latching shoulder 811 or 813, unless prevented by other means, may engage stud 816 to prevent downward movement of arm 551 when follower 555 rides off the high dwell of cam 560. When such engagement is effected, all locking slides 502 are held retracted, and all set pins 500, depressed in accordance with the perforation pattern registered by depressed translator wires 490, are restored by their springs to their upper position as the set pin box descends later in the cycle. As a result, the perforation pattern temporarily set up in the set pin box is cancelled or erased, and set pins 500 are ineffective to cause punching in a detail card at the end of the cycle. As hereinafter explained, the arrangement of arms 810 and 812 is such that arm 810 may be rendered effective to engage stud 816 to prevent punching when a non-comparison is sensed, whereas, arm 812 may be rendered effective to engage stud 816 to prevent punching when a comparison is sensed.

To determine which, if either, of the arms 810 or 812 is to be effective during a given operation,

manually settable means are provided to position the arms in accordance with the type of operation to be performed. For this purpose, a manually settable punch control lever 800 (Figs. 1, 1A, 2 and 3) is pivotally mounted on a frame stud 652, and is connected at its lower end to a link 801 which is provided with a slot 802, at its left end, encompassing a shoulder stud 803, fast on bracket 550, to guide the link for horizontal movement. The upper end of lever 800 projects through the frame of the machine at a point adjacent to the operation selector dial 700 (see Fig. 1A), in a convenient position for the operator, so that it may be set to either an upper position (U), a lower position (L), or an intermediate position (I), in each of which it is retained by a spring urged detent pawl 804 (Figs. 1 and 2), pivoted on bracket 550, that engages notches on the lower side of link 801. Fixed on link 801 is a stud 805 that projects between arms 810 and 812, and is arranged to coast with the inner edges thereof. The diameter of stud 805 is such that when lever 800 is set in its intermediate position, as shown in Figs. 1 and 2, the latching shoulders 811 and 813 of arms 810 and 812 are held out of engagement with stud 816 at all times. Thus, when lever 800 is set in its intermediate position, arms 810 and 812 are ineffective to hold locking slides 502 retracted, whereby the set pin box functions, as described above, to sense and retain a master card perforation pattern during each cycle, and to transfer such pattern to a detail card held in the punch chamber.

However, when lever 800 is moved to its upper position, link 801 is shifted to the right, from its position in Figs. 1 and 2, whereby stud 805 rocks latching shoulder 813 on arm 812 further out of engagement with stud 816, but frees arm 810 to permit the engagement of shoulder 811 with stud 816 unless such engagement is prevented by other means, as hereinafter described; whereas, when lever 800 is moved to its lower position, link 801 is shifted to the left, from its position in Figs. 1 and 2, whereby stud 805 rocks latching shoulder 811 on arm 810 further out of engagement with stud 816, but frees arm 812 to permit the engagement of shoulder 813 with stud 816 unless such engagement is prevented by other means, as hereinafter described.

For causing the engagement of arms 810 and 812 with stud 816 to prevent the retention of perforation patterns in the set pin box under control of the comparing mechanism, a cam 770 (see Figs. 1 and 2), similar in contour to the correspondingly designated cam in the cited patent, is fixed to sleeve 600 of the control device. Coacting with cam 770 is a roller 771 carried on the horizontal arm of a bell-crank 772 pivoted, at 773, on the left end of a lever 774 pivotally mounted on frame stud 652. Connected to the pendant arm of bell-crank 772 is a link 820 joined by pin-in-slot connections to a link 821 (see also Fig. 4) to which is fixed a stud 825 that projects between arms 810 and 812, and is arranged to coact with the inner edges thereof. A comparatively strong spring 822, extended between a stud 823 on link 820 and a stud 824 on link 821, urges link 821 to the right to the limit of the slots in link 820, and tends to cause both links to move in unison. A lighter spring 826, extended between stud 824 and a shoulder stud 827, that is fixed in bracket 550 and passes through a slot in link 821 to guide the link for substantially horizontal movement, urges the linkage 820, 821 to

the left and, also, tends to maintain a roller 771 in engagement with the cam 770 when the cam is rendered effective to control detail card punching. With this arrangement, when roller 771 is in register with a low dwell of cam 770, as in the case when a comparison is sensed, spring 826 pulls linkage 820, 821 to the left whereby stud 825 rocks arm 810 counter-clockwise to prevent the engagement of latching shoulder 811 with stud 816 (as in Figs. 1 and 2), and, if stud 805 is momentarily disregarded, permits the engagement of latching shoulder 813 with stud 816. However, when roller 771 is in register with a high dwell of cam 770, as in the case when a non-comparison is sensed, bell-crank 772 is rocked counter-clockwise to pull linkage 820, 821 to the right whereby stud 825 rocks arm 812 clockwise to prevent the engagement of latching shoulder 813 with stud 816, and, if stud 805 is momentarily disregarded, permits the engagement of latching shoulder 811 with stud 816.

In order to render cam 770 effective, means corresponding to those disclosed in the cited patent are provided to select this cam for operation when selective detail card punching is required. For this purpose, a cam lug 777 may be placed at any desired position on a disc 778 which is secured to sleeve 702 of the operation selector mechanism. Then, when operation selector dial 700 is rotated to a position to place a lug 777 in register with a roller 776, carried on the right end of lever 774, lever 774 is rocked clockwise to elevate pivot 773 whereby roller 771 is moved into operative relationship with cam 770 to render the cam effective for controlling card punching operations.

By means of the above described mechanism, either of three different types of card punching operations may be effected, in accordance with the setting of punch control lever 800, at any setting of the operation selector dial 700 in which a cam lug 777 is placed in register with roller 776 to render punch control cam 770 effective. Thus, the machine may be set to

1. Punch additional data in comparing detail cards and prevent punching of additional data in non-comparing detail cards, or
2. Punch additional data in non-comparing detail cards and prevent punching of additional data in comparing detail cards, or
3. Punch additional data in all detail cards, whether or not their designative perforation patterns compare with those of the associated master cards.

To effect the first of these operations, punch control lever 800 is set in its upper position U (Fig. 1A). This setting shifts link 801 to the right and causes stud 805 to rock arm 812 clockwise to maintain latching shoulder 813 out of engagement with stud 816, but tensions spring 815 to urge latching shoulder 811 on arm 810 into engagement with stud 816. During cycles in which a comparison is sensed between master and detail card designative perforation patterns, a low dwell of cam 770 is in register with roller 771, as shown in Figs. 1 and 2, so that spring 826 holds linkage 820, 821 to the left whereby stud 825 holds arm 810 rocked counter-clockwise to prevent the engagement of shoulder 811 with stud 816. In this position of the parts, shoulder 811 is ineffective to engage stud 816 so that the punch set pin retract mechanism is free to operate momentarily near the mid-point of each cycle, as described above, to release all previously depressed set pins 500 and

to permit the locking of all set pins 500 that are depressed in accordance with each new master card perforation pattern. Thus, during cycles in which a comparison is sensed, the punch mechanism operates, in the usual manner, to transfer additional data from master cards to comparing detail card. However, when a non-comparison is sensed between master and detail card designative perforation patterns, sleeve 600 and cam 770 are rotated, as described above, to place a high dwell of the cam in register with roller 771. Bell-crank 772 is thereby rocked counter-clockwise to shift linkage 820, 821 and stud 825 to the right to permit spring 815 to rock arm 810 clockwise. Inasmuch as the actuation of cam 770 occurs at the beginning of a cycle, at which time the retract mechanism is in the position shown in Fig. 1 (see also Fig. 5) this movement merely serves to move shoulder 811 against the side of stud 816. However, when push rod 552 is elevated by cam 560, near the mid-point of the cycle, it serves to rock arm 551 and shaft 548 to shift all locking slides 502 to the right to release all set pins 500 (as in Fig. 2). Arm 810 is thereby elevated and latching shoulder 811 is engaged with stud 816 by spring 815 whereby shaft 548 is locked in rocked position to retain all locking slides 502 in their rightward positions. Due to the coaction between roller 546 and the vertical face 545 on the arms 542 supporting bail bar 541, this condition is maintained when the set pin box moves downwardly, and is continued as long as roller 771 remains in register with a high dwell of cam 770. Thus, when a non-comparison is sensed, locking slides 502 are rendered ineffective to lock set pins 500, and the transfer of additional data to non-comparing detail cards is prevented.

When another comparison is sensed sleeve 600 and cam 770 are again actuated, as described above, to place another low dwell of the cam in register with roller 771, whereby spring 826 tends to move linkage 820, 821 and stud 825 to the left to disengage shoulder 811 from stud 816. However, due to the fact that the force exerted by the springs that tend to restore locking slides 502 to the left is substantially greater than that exerted by spring 826, shoulder 811 remains engaged with stud 816 until cam 560 again rocks arm 551. When this occurs, disengagement of shoulder 813 and stud 816 is effected by spring 826 to permit the resumption of the normal operation of the punch retract mechanism.

To effect the second of the above mentioned operations, punch control lever 800 is set in its lower position L (Fig. 1A). This setting shifts link 801 to the left and causes stud 805 to rock arm 810 counter-clockwise to maintain latching shoulder 811 out of engagement with stud 816, but tensions spring 815 to urge latching shoulder 813 on arm 812 into engagement with stud 816. During cycles in which a non-comparison is sensed between master and detail card designative perforation patterns, a high dwell of cam 770 is in register with roller 771. Bell-crank 772 is thereby rocked counter-clockwise to shift linkage 820, 821 to the right to cause stud 825 to rock arm 812 clockwise and retain latching shoulder 813 out of engagement with stud 816. In this position of the parts, shoulder 813 is ineffective to engage stud 816 so that the set pin retract mechanism is free to operate momentarily near the mid-point of each cycle, as described above, to release all previously depressed set pins 500, and to permit the locking of all set pins 500 that are depressed in accordance with each new master card perforation pat-

tern. Thus, during cycles in which a non-comparison is sensed, the punch mechanism operates, in the usual manner, to transfer additional data from master cards to non-comparing detail cards. However, when a comparison is sensed between master and detail card designative perforation patterns, sleeve 600 and cam 770 are rotated, as described above, to place a low dwell of the cam in register with roller 771. Spring 826 is then free to shift linkage 820, 821 and stud 825 to the left to permit spring 815 to rock arm 812 counter-clockwise. Inasmuch as this actuation of cam 770 occurs at the beginning of a cycle, at which time the retract mechanism is in the position shown in Fig. 1 (see also Fig. 5), this movement merely serves to move shoulder 813 against the side of stud 816. However, when push rod 552 is elevated by cam 560, near the mid-point of the cycle, it serves to rock arm 551 and shaft 548 to shift all locking slides 502 to the right to release all set pins 500 (as in Fig. 2). Arm 812 is thereby elevated and latching shoulder 813 is engaged with stud 816 by spring 815 whereby shaft 548 is locked in rocked position to retain all locking slides 502 in their rightward positions. Due to the coaction between roller 546 and the vertical face 545 on the arms 542 supporting bail bar 541, this condition is maintained when the set pin box moves downwardly, and is continued as long as roller 771 remains in register with a low dwell of cam 770. Thus, when a comparison is sensed, locking slides 502 are rendered ineffective to lock set pins 500, and the transfer of additional data to comparing detail cards is prevented.

When another non-comparison is sensed sleeve 600 and cam 770 are again actuated, as described above, to place another high dwell of the cam in register with roller 771 whereby bell-crank 772 is rocked counter-clockwise to move link 820 to the right, and through spring 822, tends to move link 821 and stud 825 to the right to disengage shoulder 813 from stud 816. However, due to the fact that the force exerted by the springs that tend to restore locking slides 502 to the left is substantially greater than that exerted by spring 822, shoulder 811 remains engaged with stud 816, and spring 822 is momentarily tensioned, until cam 560 again rocks arm 551. When this occurs, disengagement of shoulder 811 and stud 816 is effected by spring 822 to permit the resumption of the normal operation of the punch retract mechanism.

To effect the third of the above mentioned operations, punch control lever 800 is set in its intermediate position I (Fig. 1A). This setting shifts link 801 to its middle position (as in Figs. 1 and 2), and places stud 805 in vertical alignment with stud 816 wherein arms 810 and 812 are held at a sufficient angle to prevent the engagement of either latching shoulder 811 or 813 with stud 816. In this position of the parts, the set pin retract mechanism is free to operate momentarily near the mid-point of each cycle, as described above, to release all previously depressed set pins 500, and to permit the locking of all set pins 500 that are depressed in accordance with each new master card perforation pattern. Thus, during each cycle, the punch mechanism operates, in the usual manner, to transfer additional data from a master card to a detail card whether there is a comparison or a non-comparison between the designative perforation patterns in such cards.

In connection with the transfer of perforation patterns it will be noted that when the punch

translator is provided with a full complement of translator wires 490 in each column, the entire perforation pattern of a master card, including designative data as well as additional data, is transferred to the associated detail card. Insofar as transfers to detail cards with comparing designative perforation patterns are concerned, as in the first of the above mentioned operations, this arrangement presents no difficulty since it merely results in passing punch gags through perforations already contained in the designative field of the comparing detail card. However, insofar as transfers to detail cards with non-comparing designative perforation patterns are concerned, as in the second and third of the above mentioned operations, this arrangement would cause the master card designative perforation pattern to be superimposed on the designative perforation pattern already contained in the non-comparing detail card. Inasmuch as this would spoil the designative pattern in the detail card, it is necessary, in the latter types of operation, to remove or render ineffective the translator wires 490 that correspond to the card columns in which the designative perforation patterns are contained.

It will be noted that the mechanism of the present invention, when lever 800 is in its intermediate setting, permits the several other cams for controlling card feeding, card sorting, or machine stopping that may be mounted on sleeve 600, as described in the cited patent, to control differentially their respective operations in the usual manner when comparisons or non-comparisons are sensed, but renders cam 770 wholly ineffective for controlling punching operations even though it may have been selected for operation by operation selector dial 700. Whereas, when lever 800 is set in either its upper or lower position, punch control cam 770 operates conjointly with any selected combination of card feeding, card sorting, or machine stopping cams to effect the desired card handling operation. The various groups of card handling operations that may be effected at a single setting of the operation selector dial on a statistical card comparing machine of the type disclosed in the cited patent, when equipped with the present invention, are graphically illustrated in Fig. 7. Referring to group A of Fig. 7, for example, it will be noted that when card sorting control cam 780 is rendered effective by means of operation selector dial 700, in addition to punch control cam 770 and any desired card feeding control cam, the machine may be conditioned to perform three different operations, corresponding to operations 7, 9, and 27 of Fig. 74 of the cited patent, merely by manipulating punch control lever 800. In the previously disclosed machine, a separate setting of the operation selector dial is required to effect each operation. In addition, at the same setting of the operation selector dial, the present machine may be set to effect operation 1 of Fig. 74 of the cited patent, merely by removing the punch translator. In the latter instance, since the removal of the punch translator renders the punch mechanism wholly ineffective, the setting of lever 800 is immaterial and has been designated by an X in Fig. 7.

Similarly, the groups B to I, inclusive, of Fig. 7, indicate the various sets of operations, corresponding to operations described in the cited patent and indicated on Fig. 74 thereof, that may be effected by manipulation of lever 800 and the punch translator, at a given setting of

operation selector dial 700, when punch control cam 770 is rendered effective conjointly with sorting control cam 780 and/or stopping control arm 760 of the cited patent, in each of the several combinational settings of these cams. Obviously, in each instance, any one of the several card feeding control cams described in the patent may also be rendered effective to obtain the type of card feeding required in a specific accounting or statistical system.

Thus, the present invention, when applied to a statistical card comparing machine of the type disclosed in the cited patent, renders such a machine exceedingly more flexible and capable of performing a substantially greater number of card handling operations.

In Fig. 3 there is a partial illustration of a typical application of the present invention. In this figure, which corresponds to Fig. 56 of the cited patent, there is disclosed a portion of the operation selector mechanism comprising the actuating mechanism for sleeve 600 and the control cams thereon; operation selector dial 700; punch control cam 770 and its associated linkage 772, 773, 774, etc., as described hereinabove, including punch control lever 800; card sorting control cam 780 and its associated linkage 782, 783, 784, etc., as disclosed in Figs. 56 and 71 of the cited patent, for sorting comparing and non-comparing master and detail cards; and card feed control disc 710 and its associated linkage 712, 713, 714, etc., as disclosed in Figs. 56 and 32 of the cited patent, for effecting master and detail card feeding during each machine cycle. When the above mentioned control cams are rendered effective simultaneously at a setting of operation selector dial 700, the machine may be conditioned to perform either of the card handling operations included in Group A of Fig. 7 merely by manipulating punch control lever 800, or by withdrawing the punch translator. In either case, the master and detail cards will be handled and disposed of in the manner indicated in connection with the corresponding operation number in Fig. 75 of the cited patent. Obviously, any desired combinational operation of card feeding, card sorting, or machine stopping may be employed in conjunction with the punch control mechanism of the present invention by mounting such control cams on sleeve 600 and arranging to render them effective selectively under control of the operation selector dial 700. Although specific card handling problems are not considered herein, the utility of this arrangement will be readily apparent to those skilled in the application of record controlled machines to accounting and statistical systems.

While I have described what I consider to be a highly desirable embodiment of my invention, it is obvious that many changes in form could be made without departing from the invention.

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

1. In a machine for handling master and detail records and including a comparing mechanism for sensing comparisons or non-comparisons between perforation patterns in preselected portions of such records, the combination of a punch mechanism for transferring additional perforation patterns from master records to detail records, a plurality of punch disabling means to prevent the transfer of perforation patterns, means under the control of the comparing mechanism to render one of said punch disabling means ineffective when a comparison is sensed and to render a second of said punch disabling means in-

effective when a non-comparison is sensed, and additional means settable to render said punch disabling means ineffective selectively, regardless of the action of the comparing mechanism.

2. In a machine for handling master and detail records and including a comparing mechanism for sensing comparisons or non-comparisons between perforation patterns in preselected portions of such records, the combination of a punch mechanism for transferring additional perforation patterns from master records to detail records, a plurality of punch disabling means to prevent the transfer of perforation patterns, means under control of the comparing mechanism to render one of said punch disabling means ineffective when a comparison is sensed and to render a second of said punch disabling means ineffective when a non-comparison is sensed, and additional means settable to render said punch disabling means ineffective selectively or concomitantly, regardless of the action of the comparing mechanism.

3. In a machine for handling master and detail records, including a comparing mechanism for sensing comparisons or non-comparisons between perforation patterns in preselected portions of such records; the combination of a punch mechanism for transferring additional perforation patterns from master records to detail records; said punch mechanism including a plurality of set pins selectable under control of the master records, locking slides operative to retain selected set pins in position to effect punching, and means to render said locking slides ineffective momentarily during each machine cycle; a plurality of disabling means to retain the locking slides in ineffective position whereby the transfer of perforation patterns is prevented; means under control of the comparing mechanism to render one of said disabling means ineffective when a comparison is sensed, and to render a second of said disabling means ineffective when a non-comparison is sensed, and additional means settable to render said disabling means ineffective selectively, regardless of the action of the comparing mechanism.

4. In a machine for handling master and detail records, including a comparing mechanism for sensing comparisons or non-comparisons between perforation patterns in preselected portions of such records; the combination of a punch mechanism for transferring additional perforation patterns from master records to detail records; said punch mechanism including a plurality of set pins selectable under control of the master records, locking slides operative to retain selected set pins in position to effect punching, and means to render said locking slides ineffective momentarily during each machine cycle; a plurality of disabling means to retain the locking slides in ineffective position whereby the transfer of perforation patterns is prevented; means under control of the comparing mechanism to render one of said disabling means ineffective when a comparison is sensed, and to render a second of said disabling means ineffective when a non-comparison is sensed, and additional means settable to render said disabling means ineffective selectively or concomitantly, regardless of the action of the comparing mechanism.

5. In a machine for handling master and detail records, including a comparing mechanism for sensing comparisons or non-comparisons between perforation patterns in preselected portions of such records; the combination of a punch mecha-

nism for transferring additional perforation patterns from master records to detail records; said punch mechanism including a plurality of set pins selectable under control of the master records, locking slides operative to retain selected set pins in position to effect punching, and a retract mechanism operative during each machine cycle to render said locking slides ineffective momentarily for retaining selected set pins; a pair of spring urged latches to retain said retract mechanism in operated position whereby the locking of selected set pins is prevented; means under control of the comparing mechanism to render one of said latches ineffective when a comparison is sensed, and to render the other of said latches ineffective when a non-comparison is sensed, and additional means settable to render said latches ineffective selectively, regardless of the action of the comparing mechanism.

6. In a machine for handling master and detail records, including a comparing mechanism for sensing comparisons or non-comparisons between

perforation patterns in preselected portions of such records; the combination of a punch mechanism for transferring additional perforation patterns from master records to detail records; said punch mechanism including a plurality of set pins selectable under control of the master records, locking slides operative to retain selected set pins in position to effect punching, and a retract mechanism operative during each machine cycle to render said locking slides ineffective momentarily for retaining selected set pins; a pair of spring urged latches to retain said retract mechanism in operated position whereby the locking of selected set pins is prevented; means under control of the comparing mechanism to render one of said latches ineffective when a comparison is sensed, and to render the other of said latches ineffective when a non-comparison is sensed, and additional means settable to render said latches ineffective selectively or concomitantly, regardless of the action of the comparing mechanism.

KARL J. BRAUN.