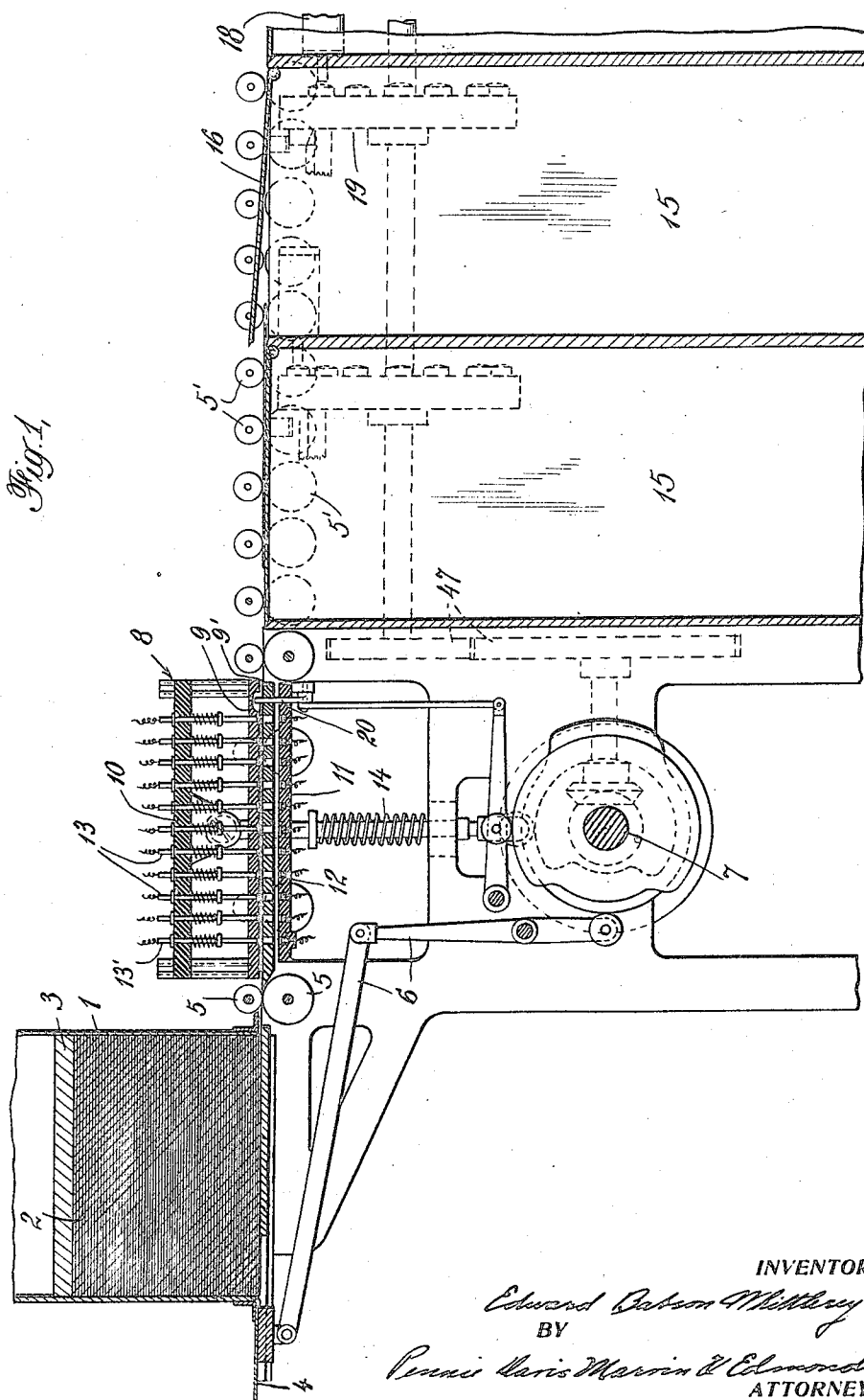


Mar. 20, 1923.

1,449,078.

E. B. WHITTLESEY,  
CARD SORTING MACHINE.  
FILED JULY 29, 1922.

4 SHEETS—SHEET 1.



INVENTOR

*Edward B. Whittlesey*

BY

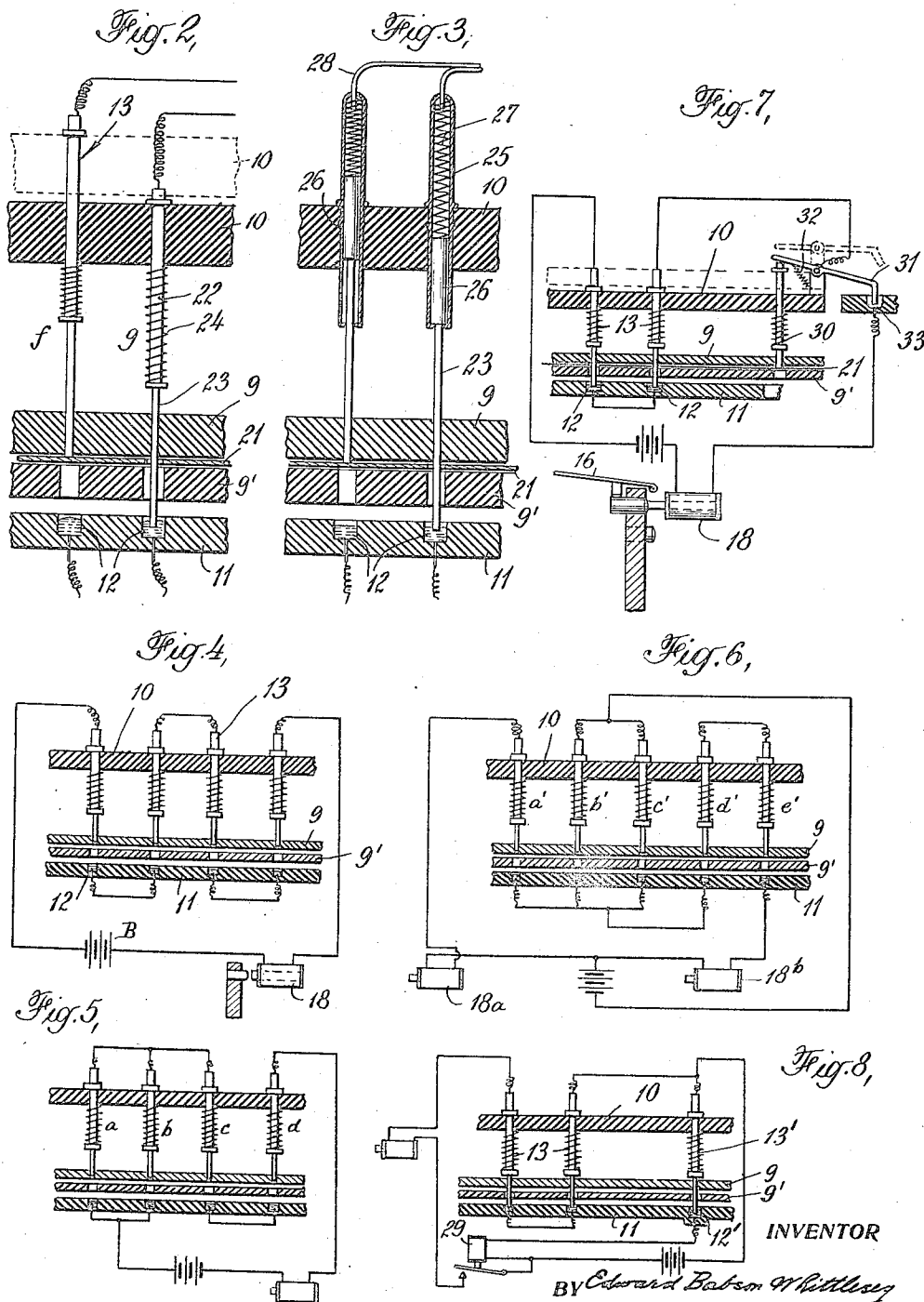
*Renai Keris Martin & Edwards*  
ATTORNEY

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4 SHEETS—SHEET 2.



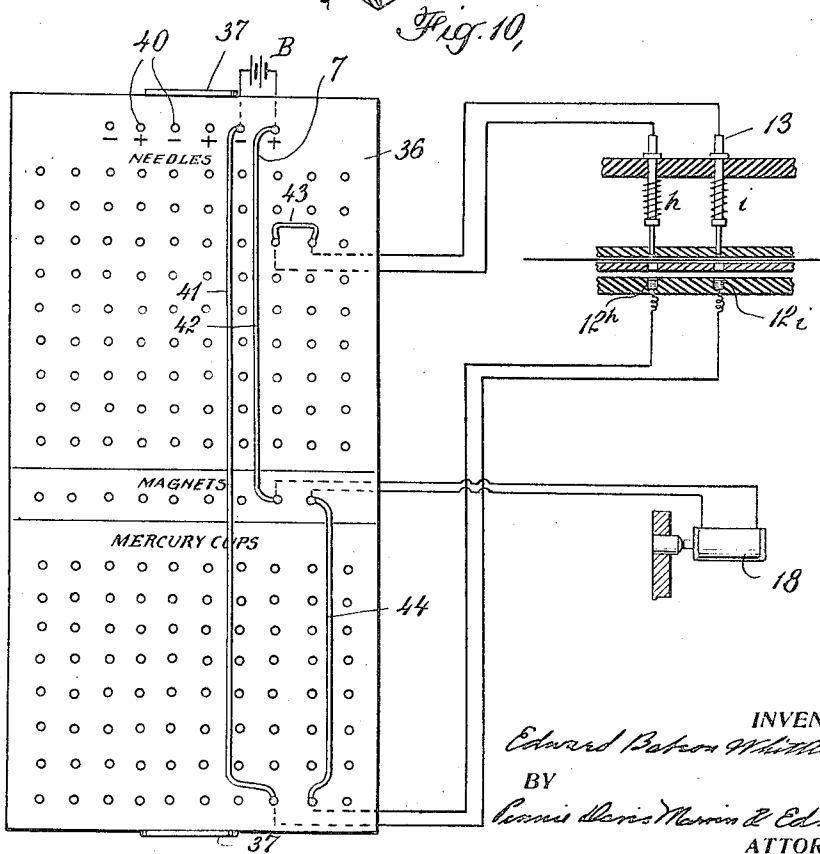
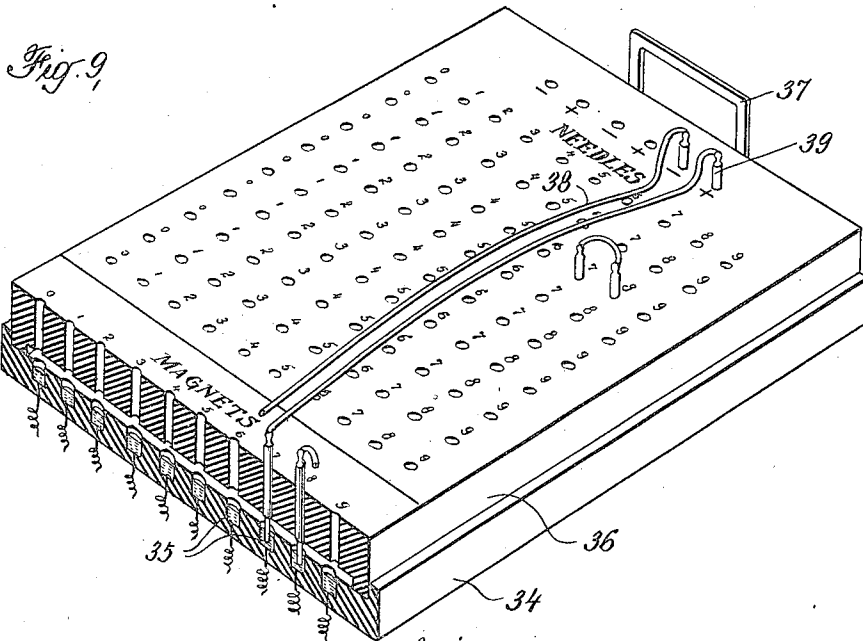
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4 SHEETS—SHEET 3.



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4 SHEETS—SHEET 4.

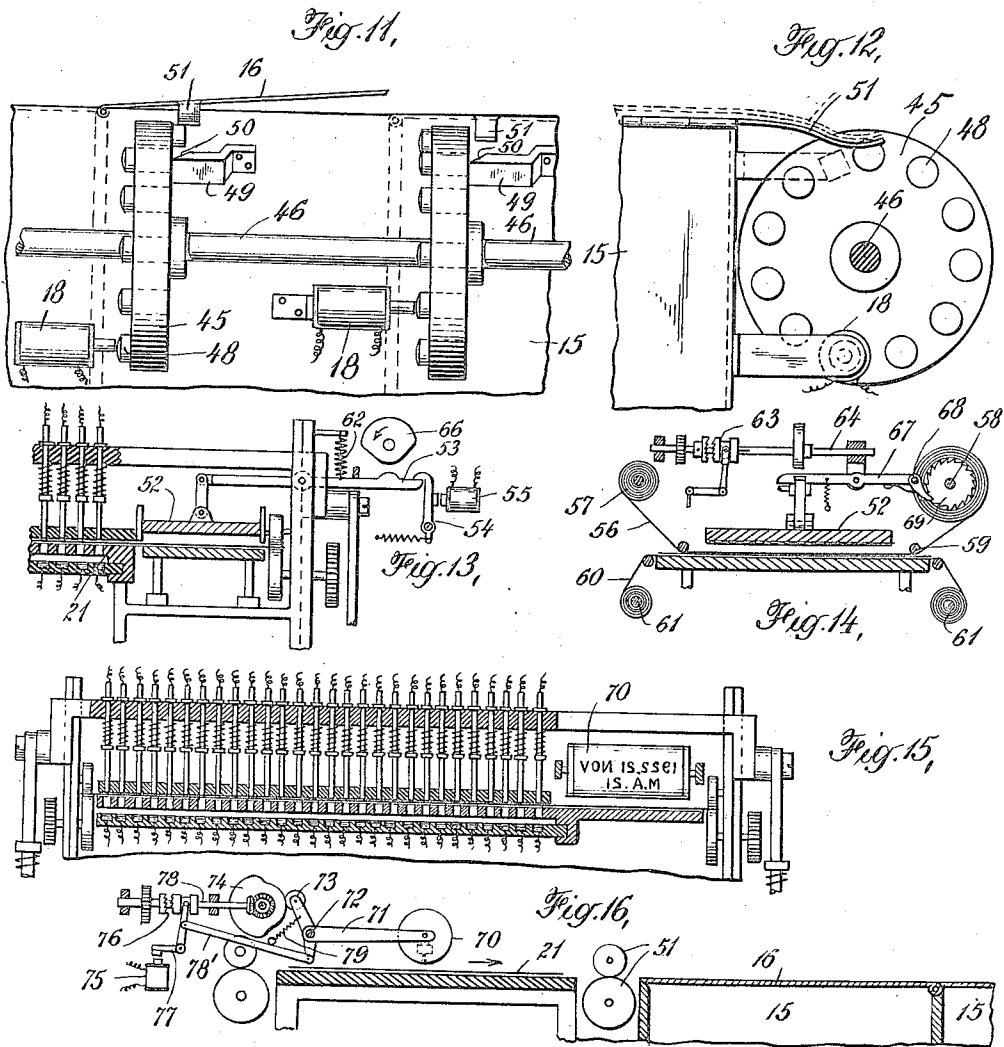


Fig. 16, Fig. 17,

| YEAR | WEEK | ZONE | R  | S  | T  | U  | TOTAL |
|------|------|------|----|----|----|----|-------|
| 00   | 00   | 00   | 00 | 00 | 00 | 00 | 0000  |
| 11   | 11   | 11   | 11 | 11 | 11 | 11 | 1111  |
| 22   | 22   | 22   | 22 | 22 | 22 | 22 | 2222  |
| 33   | 33   | 33   | 33 | 33 | 33 | 33 | 3333  |
| 44   | 44   | 44   | 44 | 44 | 44 | 44 | 4444  |
| 55   | 55   | 55   | 55 | 55 | 55 | 55 | 5555  |
| 66   | 66   | 66   | 66 | 66 | 66 | 66 | 6666  |
| 77   | 77   | 77   | 77 | 77 | 77 | 77 | 7777  |
| 88   | 88   | 88   | 88 | 88 | 88 | 88 | 8888  |
| 99   | 99   | 99   | 99 | 99 | 99 | 99 | 9999  |

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## UNITED STATES PATENT OFFICE.

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## CARD-SORTING MACHINE.

Application filed July 29, 1922. Serial No. 578,282.

*To all whom it may concern:*

Be it known that I, EDWARD BABSON WHITTLESEY, a citizen of the United States, residing at New York city, in the county of New York, State of New York, have invented certain new and useful Improvements in Card-Sorting Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to an improved method of sorting perforated cards and to improvements in sorting machines of the type which is particularly adapted to sort perforated record cards.

Sorting machines of this general character ordinarily comprise a card receptacle for holding a stack of cards to be sorted; means for conveying the cards one at a time; means for analyzing the cards; and a plurality of pockets or card receptacles for receiving the analyzed cards. The cards which these machines are designed to sort are in common use and are ordinarily of paste board or fibre. Such cards have spaces which may be punched, as desired, to record data of various kinds.

The receptacles for holding the cards to be sorted are of several forms. All of these forms comprise, in general, a means for holding the cards, means for exerting a compressive force on the stack of cards, and reciprocating means for feeding cards from the stack one at a time. Each card in passing from the stack passes between two bed plates provided with perforations corresponding to the spaces on the card. Means is provided for holding the card in position between the bed plates until it is analyzed by a mechanism to be described hereinafter. After the card is analyzed it is carried by means of a suitable conveyor to a card pocket. If a given card contains the required arrangement of perforations or index points, the analyzer functions so that the card is conveyed to a predetermined pocket. If the card does not contain the necessary combination of holes, it passes to a discard pocket.

Various types of analyzing mechanisms have been used which operate either electrically or mechanically. A common type of electrically operated analyzer or pin box, as it is ordinarily called, comprises a reciprocating plate arranged above the bed plates and carrying a plurality of pins, the number and arrangement corresponding with the holes in the bed plates. A contact plate is provided below the bed plates, the contact plate having a plurality of mercury cups, or their equivalent, also corresponding in number and arrangement with the holes in the bed plates, and, therefore, with the perforations and spaces of the card which is to be analyzed. The arrangement of the analyzing mechanism is such that when the reciprocating plate is lowered, the pins which come in contact with the unperforated portions of the card are arrested and do not make electrical contact with the mercury cups in the contact plate. The pins which are in register with the perforations in the card pass through these perforations and make electrical contact with the corresponding mercury cups below.

Heretofore, it has been common to interconnect or short-circuit all of the pins so that when contact is made through the perforations, the mercury cups are all connected in parallel. One method of sorting cards by means of the apparatus described above is as follows:

An electromagnet, or its equivalent, is provided for each of the pockets or sorting boxes. If it is desired to select all the cards having, for example, three particular perforations, a given sorting box will be selected into which these cards are to be placed. The corresponding sorting box electromagnet is then connected to the terminals of a battery, the circuit being open at three contact points, the number of contact points corresponding to the number of perforations in the card. This circuit may be termed a secondary circuit. The primary circuit comprises a battery, which is separate from the battery above mentioned, the pins of the pin box, the three mercury cups corresponding to the three perforations in the given card, and three relays connected in series

with the three mercury cups, each relay being adapted to close one of the contacts of the secondary circuit.

From the foregoing, it will be evident, that, when a card having the three required perforations, is analyzed, the pins corresponding to these perforations will make contact with three of the mercury cups. This will cause the primary circuit relays to close the contacts in the secondary circuit, thus energizing the sorting box electromagnet. The operation of the latter establishes conditions which cause the card to be deposited in the sorting box.

It is obvious that sorting machines of the type above described are not satisfactory when it is desired to select cards according to combinations consisting of a large number of perforations. This is due to the fact that a primary relay must be provided for each of the required perforations, and separate primary and secondary circuits must be used.

Accordingly, one object of the present invention is to provide a very simple method of sorting cards, and to provide a machine which is adapted to select cards having any arrangement of perforations, the machine being designed so that it is not necessary to use any relays, solenoids, or electromagnets, except the sorting box electromagnets.

The fundamental principle, upon which my improved method of sorting cards is based, is that electric current is passed through the perforations of the card, the perforations being connected in series and parallel. While I have stated that the perforations are thus connected, it should be understood that I refer to the corresponding pins which are connected in series and parallel through these perforations. I have found that if instead of passing the current in the same direction through all of the required perforations of a given combination, the perforations are connected in series and the current is passed alternately up and down through the perforations that a very simple machine may be used to perform this process, and the use of a multiplicity of relays is entirely avoided.

The principal change in the machine, as it is now known, is that the pins of the pin box and the mercury cups, or their equivalent, are all insulated from each other, while in the ordinary construction, either the pins are all electrically connected together, or all of the contacts below the bed plates are short-circuited. The primary advantage of the present invention lies in the use of series circuits instead of parallel circuits.

The following detailed description, taken in conjunction with the accompanying drawings, relates to a type of machine by which my improved method of sorting cards

may be practiced, and to various improvements in the sorting machine itself.

Fig. 1 is a fragmentary view partly in section showing the principal parts of the card sorting machine.

Fig. 2 is a fragmentary section of a form of pin box which may be used.

Fig. 3 is a view similar to Fig. 2 showing an improved pin construction.

Figs. 4, 5 and 6 show several electrical circuits that may be employed for the purpose of carrying out the improved method of sorting cards.

Figs. 7 and 8 are fragmentary views showing two types of apparatus for opening and closing the pin box circuits.

Fig. 9 is a perspective view, partly in section, showing an improved compound switchboard.

Fig. 10 is a plan view of the switchboard of Fig. 9 showing the manner in which the electrical circuits are completed through the switchboard.

Fig. 11 is a fragmentary view of an improved mechanism for operating the lids of the sorting boxes.

Fig. 12 is an end view of the mechanism shown in Fig. 11.

Fig. 13 is a fragmentary view, partly in section, showing a stencilling device adapted to be used in conjunction with the analyzer.

Fig. 14 is a section view of the stencilling device, taken at right angles to the view shown in Fig. 13.

Fig. 15 is a longitudinal section of an analyzer provided with a printing mechanism.

Fig. 16 is a fragmentary view showing the details of the printing apparatus; and

Fig. 17 is a plan view of a record card having a stencil provided in the end thereof.

The apparatus shown in Fig. 1 comprises a card receptacle 1 holding a stack of cards 2 held in place by the heavy cover 3. A reciprocating plate 4 is provided at the bottom of the receptacle 1 for the purpose of delivering cards one at a time from the receptacle 1 to the feed rollers 5. The reciprocating plate 4 is operated by means of suitable links 6 actuated by a cam shaft 7. The feed rollers 5 deliver each card to the analyzing mechanism 8. This analyzing mechanism 8 comprises two bed plates 9 and 9' and a reciprocating plate 10 located above the bed plates. A contact plate 11 is provided below the bed plate 9'. The bed plates 9 and 9' have holes or perforations therein corresponding in number and arrangement with the spaces on the record card which is shown in Fig. 17. The contact plate 11 is provided with a plurality of mercury cups 12 corresponding in number and arrangement with the holes in the bed plates 9 and 9'. The reciprocating plate 10 is provided

with a plurality of pins 13 which also correspond in arrangement with the holes in the bed plates. The number of pins 13 is preferably equal to the number of holes in the bed plates, but, if desired, a small number of removable pins may be employed, these being arranged at will to establish the necessary circuits. The reciprocating plate 10 is operated by means of a suitable link 14 which may be actuated by the cam shaft 7.

A plurality of feed rollers 5' is provided beyond the analyzer for the purpose of conveying the analyzed cards to the selective devices or sorting boxes 15, each of which is provided with a hinged lid 16.

As shown in Fig. 2, the pins 13 are yieldingly mounted in a pin box; that is, they are so constructed that when the reciprocating plate 10 is lowered, the movement of those pins to which no perforations in the card are presented, is arrested by the card.

Each sorting box is provided with an electromagnet 18 which is arranged to operate the mechanism 19 which actuates the lids 16 of the sorting boxes.

The improved method of sorting cards may be understood by referring to Figs. 1, 2 and 4. The bottom card in the stack 2 is engaged by the reciprocating plate 4 which forces the card into contact with the feed rollers 5. These rollers 5 convey the card between the bed plates 9 and 9'. A detent 20 operated by the cam shaft 7 prevents the card from passing through the analyzing mechanism for a definite period, and positions the card properly with respect to the holes in the bed plate. The rotating shaft 7 then causes the reciprocating plate 10 to be lowered. The pins 13 in register with the perforations in the card pass through these perforations or index points and make electrical contact with the mercury cups 12 in the contact plate 11, the remaining pins being supported by the unperforated spaces on the card so that no electrical contact is made thereby. If, for example, the four pins shown in Fig. 4 are connected as shown in this figure the electrical circuit will be closed when these four pins make contact with the corresponding mercury cups in the contact plate 11. When this condition exists current will flow in the circuit, the current being supplied by a battery B, or other source of electrical energy, and the sorting box electromagnet 18 will function. The reciprocating plate 10 is then raised, the detent 20 lowered by the rotating cam shaft 7 and the card is carried forth by the rollers 5'. The card passes over the tops of the sorting boxes until it approaches the sorting box corresponding with the electromagnet which was caused to function when the card was analyzed. The mechanism for actuating the sorting box lid opens the lid

just as the card reaches this box, and the card falls into the box.

It should be noted that with the arrangement shown in Fig. 4 the current passes through the perforations in the card 21, the perforations being connected in series and the current passing alternately up and down through the succeeding perforations.

It will be seen that the improved method of sorting cards depends upon the closing of a plurality of definite electrical contacts corresponding with a given combination of perforations or index points in the card. In Fig. 4 the contacts are all connected in series and when they are all closed the electric current flows in the circuit and operates a sorting box electromagnet. The pins 13 are all insulated from each other, as are also the mercury cups 12 in the contact plate 11. This may be accomplished by making the reciprocating plate 10 of insulating material, or by providing an insulating collar for each pin. The contact plate 11 is preferably made of insulating material such as hard rubber or bakelite. The upper and lower bed plates 9 and 9' are also constructed preferably of insulating material. If it is desired, however, the cards may be passed through the analyzer in contact with the contact plate 11, and a single plate may be substituted for the plates 9 and 9'.

In Fig. 5 a series parallel arrangement is illustrated. The pins *a* and *b* are connected in parallel and this group is connected in series with a pin *c*. The latter may be connected in series with the pin *d* so that a circuit may be closed through pins *c*, *d* and either *a* or *b*, or both. This combination may be used when it is desired to select all of the cards having two separate items and also one or both of two other items recorded thereon.

The arrangement shown in Fig. 6 comprises the combination of two series parallel circuits, this arrangement being used when it is desired to select two groups of cards. All cards having perforations in register with pins *a'* and *b'* or *c'* will be deposited in the sorting box controlled by electromagnet 18<sup>a</sup>, and all the cards having perforations in register with pins *e'*, *d'* and *c'* or *b'* will be deposited in the sorting box corresponding to the electromagnet 18<sup>b</sup>. Current will flow through electromagnet 18<sup>a</sup> when electrical contact is made through pins *a'* and *b'* or *c'* and current will flow through electromagnet 18<sup>b</sup> when contact is made through pins *e'*, *d'* and *c'* or *b'*.

By considering Figs. 4 to 6, inclusive, it should be apparent that the improved method of sorting cards comprises all possible combinations of series and parallel circuits completed through the perforations of the

cards or through contacts corresponding with the perforations. Any number of perforations, or their equivalent, located at any points on the cards may be connected in series; some perforations may be connected in parallel and others in series; the perforations may be connected in parallel; or innumerable series and parallel circuits may be employed, thus simultaneously selecting cards by depositing them in sorting boxes corresponding in number with the number of the electrical circuits which may be established. Perforations may be included in more than one circuit, but care must be exercised to avoid short circuiting perforations of one circuit by connections of another. In general this may be avoided by connecting the common perforations so that they are at the beginning of the circuits, that is, electrically connected to one terminal of the source of electrical energy, as shown in Fig. 6.

It is obvious that the improved method of sorting cards herein disclosed possesses material advantages over the methods heretofore employed. In the present invention it is not necessary to employ primary and secondary circuits, or a multiplicity of relays for closing contacts in the sorting box circuits. The number of pins that may be interconnected for the purpose of selecting cards is unlimited. All that is necessary is to interconnect the pins and mercury cups, either directly or through a suitable switchboard. Furthermore, simultaneous selection of a large number of groups of cards is possible. In the common type of sorting machine it is not practical to attempt to select cards where it is necessary to interconnect contacts corresponding with a large number of card perforations, due to the fact that innumerable relays must be employed, at least one relay for every perforation in the given combination.

In the sorting machine illustrated in the accompanying drawings various structural improvements are shown. Analyzing pins of a new form are provided, and the devices for opening and closing the pin box circuits have been improved. The mechanism for operating the sorting box lids is of a novel construction, as is also the switchboard. An auxiliary stencil mechanism is also disclosed, which may be employed if desired.

The pins 13 shown in Fig. 2 are of ordinary construction and comprise a member 22 having a needle 23 integral therewith or rigidly attached thereto. The member 22 is mounted in the reciprocating plate 10 in such a manner that it is yielding, and is normally held in its lower extreme position by means of a coil spring 24. If the pins encounter an unperforated portion of the card 21 they are supported thereby and the

reciprocating plate 10 moves down relative to the pins thus compressing the coil springs 24 as shown at *f* in Fig. 2. Each needle which passes through a perforation, as shown at *g* in Fig. 2, makes electrical contact with a mercury cup 12 in the contact plate 11.

The construction described in the preceding paragraph has several disadvantages. For example, the member 22, being loosely mounted in the reciprocating plate 10, has a tendency to become displaced laterally, and experience has shown that the needle often misses the perforation in the card. A further disadvantage is that an extensible electrical connection must be made at the upper end of the pin to allow for the vertical movement of the pin.

The improved construction shown in Fig. 3 has been devised with a view to avoiding the objectionable features inherent in the pin construction shown in Fig. 2.

In Fig. 3 a cylindrical sleeve 25 is provided, this sleeve being fixed in the reciprocating plate 10 in any suitable manner, as by providing a small annular projection 26 on the outer surface of the cylinder 25 for the purpose of securing a forced fit. The cylinder 25 has a flange restricting the bottom opening and serving as a guide for the needle 23. A plunger or piston 26 is provided on the upper end of the needle 23, this plunger being adapted to slide within the casing 25. A spring 27 within the casing 25 serves to hold the plunger 26 against the bottom of the casing. A rigid electrical contact is made at the top of the casing 25 as shown at 28.

From the preceding paragraph it should be apparent that the improved pin construction illustrated in Fig. 3 provides a practical means of insuring true vertical motion of the needles, and also provides an improved electrical construction. There is no relative movement between the casings 25 and the reciprocating plate 10; hence, there is no tendency for these parts to wear so that the pins become loose.

In Fig. 8 a mechanism is illustrated which is designed for the purpose of rendering the analyzer inoperative when there is no card between the bed plates. If the sorting machine is operated without the use of any auxiliary devices, such as counters or recorders, it is not necessary to provide any means of rendering the analyzer inoperative, due to the fact that no harm results from the opening of the sorting box when there is no card to be deposited therein. However, if auxiliary attachments of any character are employed it is necessary to provide a means for rendering the pin box inoperative when no card is being analyzed.

In Figs. 1 and 8 a pin 13' is shown which coacts with a mercury cup 12' in the contact

plate 11. The pin 13' is made substantially longer than pins 13 and is located in such a position that it can never pass through any of the perforations of the card; for example, it may be located at a point corresponding with some point on the margin of the card. Accordingly, when a card is between the bed plates 9 and 9' the pin 13' is supported by the card and does not make electrical contact with mercury cup 12'. However, when no card is being analyzed and the reciprocating plate 10 is lowered, the pin 13' makes electrical contact with the mercury cup 12', this contact being made before the pins 13 make electrical contact with the cups 12, due to the fact that the pin 13' is of greater length than the other pins. When contact is made at 12' a relay 29 is caused to function, this relay opening the main pin circuit. This prevents current from flowing in the pin circuit when the pins 13 have made contact with the corresponding mercury cups 12.

An improved mechanism for rendering the pin box inoperative when no card is being analyzed is shown in Fig. 7. In Fig. 7 a master pin 30 is shown, this pin being located at such a point that it does not pass through any perforations on any card. A lever 31 is pivoted on the reciprocating plate 10 at a point near the master pin 30. This lever 31 is normally held in a substantially horizontal position by means of a suitable spring 32. This lever is adapted to be operated by means of the master pin 30 and to close, through a mercury cup 33, the main pin circuit. When no card is being analyzed the master pin 30 is carried down by the reciprocating plate 10 and does not operate the lever 31. Accordingly the pin circuit remains open at the cup 33. When a card is being analyzed, however, the master pin 30 is supported by the card, and the continued downward movement of the reciprocating plate 10 causes the lever 31 to come in contact with the end of the pin 30, whereby the lever 31 is tilted so that electrical contact is made through the mercury cup 33. The pin circuit may then be closed through the pins 13. The lever 31 and the mercury cup 33 are preferably so adjusted that electrical contact is made thereby only after contact is made by the pins 13, and so that the circuit is broken at 33 before the circuit is broken by the pins 13. It is thus apparent that this improved mechanism not only provides a means of rendering the pin box inoperative when no card is being analyzed, but also provides a means whereby arcing at the mercury cups 12 is prevented, all the arcing taking place at the one point,—the cup 33.

Figs. 9 and 10 illustrate the improved compound switchboard which may be used in conjunction with the improved sorting

machine. A lower or base switchboard 34 is provided, this switchboard having mercury cups 35 corresponding in number with the pins and mercury cups of the analyzer, and with the electromagnets of the sorting boxes. The electrical connections are preferably made so that one section of the switchboard is connected with the pins of the analyzer and another section with the mercury cups of the analyzer, this being shown in Fig. 10. The upper switchboard 36 comprises a plate of any insulating material having holes therein corresponding in number and arrangement with the mercury cups 35 in the lower switchboard 34. The upper switchboard is provided with handles 37 so that it may be removed from the lower switchboard and the electrical connections are made on it while it is removed. Two or more upper switch boards may be used, so that connections may be set up on one board, while another is in position on the lower switchboard and the machine is operating. The electrical connections are made by means of suitable cords 38 with the plugs 39 attached at the ends thereof. These plugs are adapted to fit in the holes in the upper switchboard. The plugs 39 are long enough so that they project below the upper switchboard, and when the upper and lower switchboards are assembled, the lower ends of the plugs 39 make electrical contact with the mercury cups 35.

A simple connection is shown in Fig. 10, to illustrate the use of the switchboard. The battery B or other source of electrical energy is permanently connected to the mercury cups below the holes 40 provided in the upper switchboard 36. The pins 13 are permanently connected to corresponding mercury cups in the lower switchboard, this connection being shown in dotted lines. The mercury cups 12 in the base plate 11 of the sorting machine are permanently connected to corresponding mercury cups in the lower switchboard. The terminals of the sorting box magnets 18 are connected to corresponding mercury cups in the switchboard. As shown in the drawing cords 41, 42, 43 and 44 are used for the purpose of making the electrical connections. Cord 42 connects the positive terminal of the battery B to one terminal of the electromagnet 18. The other terminal of the electromagnet 18 is connected to the mercury cup 12<sup>h</sup> by the cord 44. The cord 43 interconnects pins *h* and *i* and cord 41 connects mercury cup 12<sup>i</sup> with the negative terminal of the battery B. The electrical circuit consists of the following elements; battery B, electromagnet 18, mercury cup 12<sup>h</sup>, pins *h* pins *i*; mercury 12<sup>i</sup> and battery B. This particular circuit is shown merely for the purpose of illustration, for it is obvious that all of the circuits may be connected up in a corresponding manner.

Figs. 1, 11 and 12 show an improved mechanism for operating the sorting box lids. This mechanism comprises a plurality of discs 45, mounted on a rod 46. The rod or shaft 46 extends along the side of the sorting machine and is geared to the shaft 7 by any suitable gear train 47. Each disc 45 has a plurality of movable lugs 48 spaced around the edge thereof. The movable lugs 48 are adapted to be displaced by means of the electromagnets 18, and after they have been so displaced they are returned to their original position by means of suitable members 49 each of which has an inclined surface 50 which comes in contact with the displaced lug as the disc is rotated the speed of the shaft 46 is adjusted by means of the gear train 47 so that a given lug 48 moves a distance equal to that between two successive lugs while the cards which have been analyzed move a distance equal to the width of one sorting box. When a card having a required combination of perforations is analyzed, the corresponding sorting box electromagnet functions and displaces the lug 48 which happens to be adjacent the electromagnet at that instant. The analyzed card is then conveyed by means of conveyor rollers 5' and the displaced lug advances as the shaft 46 rotates. When the card reaches the sorting box adjacent to the one in which it is to be deposited the displaced lug 48 has arrived at a projection 51 attached to the corresponding sorting box lid, and as the card advances the lid 16 is raised and the card falls into the box 15. The continued rotation of the shaft 46, causes the lug 48 to pass from beneath the projection 51, permitting the lid to close by gravity. Thereafter the lug strikes the cam surface 50 and is restored to its original position.

In order that the sorting box mechanism may operate in the manner described in the preceding paragraph, it is necessary to mount successive electromagnets 18 in different positions for the different sorting boxes. That is, the electromagnet for the sorting box adjacent to the analyzer would be displaced from the member 51 a distance equal to that between two successive lugs 48; the electromagnet for the second sorting box away from the analyzer would be displaced from the corresponding member 51 a distance equal to twice that between the successive lugs 48; and the other electromagnet would be disposed in like manner around the circumference of the discs 45.

It is to be understood that the sorting box mechanism may be modified considerably without departing from the spirit of the invention. For example, the discs 45 may be mounted in a plane parallel to the plane of the sorting box machine instead of transverse as shown in the drawings. Furthermore, the members 51 may be made in

different shapes and different lengths so that the lids will be actuated when the lugs 48 are in any desired position.

Various auxiliary devices may be employed in conjunction with the improved sorting machine. Counting devices for counting the cards deposited in the various pockets, data registering machines, stencil stamping machines, in fact any device which may be operated by the electric current flowing in a sorting box electromagnet circuit or its equivalent may be employed in conjunction with the improved sorting machine.

The stamping mechanism shown in Figs. 13 and 14 comprises an attachment which may be secured to the sorting machine near the pin box. The stamping mechanism consists of a reciprocating member 52 which is actuated by a lever arm 53 normally held in inoperative position by the armature 54 of the electromagnet 55. A record strip 56 in the form of a roll of paper is mounted on a suitable holder 57 and is adapted to be wound on a second holder 58. This record strip 56 passes beneath two idlers 59, the strip being in close proximity to the cards 21 as they pass between the idlers 59. An ink ribbon 60 may be mounted on suitable supports 61 in such a manner that it passes below the record card 21. The ink ribbon 60 may be wound from one support 61 to the other by suitable gearing (not shown) cooperating with the holder 58. The cards 21 may have a stencil 65 in the end thereof as shown in Fig. 17. When a card is analyzed which has the required combination of perforations for operating the stencil device, the electric circuit, including the electromagnet 55 is closed by the needles of the analyzer. This releases the lever 53 which is then operated by the spring 62 so that the reciprocating member 52 is lowered and presses the record strip against the stencil 65 and ink ribbon 60. When the electromagnet 55 functions, a second electromagnet (not shown) actuates a clutch 63 thus causing the shaft 64 to revolve. After the record is made on the record strip 56, the cam 66 on the shaft 64 has rotated far enough to return the lever 53 to its original position where it is again held in place by the armature 54. The holder 58 of the stamping device is caused to rotate by means of the lever 67 carrying the pawl 68 which engages the ratchet wheel 69. The lever 67 is actuated by the links attached to the reciprocating plate 52.

The printing mechanism shown in Figs. 15 and 16 is particularly adapted to print data of any kind on record cards having any required combination of perforations therein. A printing roll 70 is carried by a suitable rocker arm pivoted at 72. A cam follower 73 is mounted on the rocker arm and is adapted to engage the cam 74.

When a card is analyzed which has the required number of perforations to actuate the printing device, electrical contact is made so that current flows through the relay 75. This relay actuates the clutch 76 by means of suitable links 77. This connects the shaft 78 to the driven shaft 76' and the shaft 78 now rotates the cam 74. As the card leaves the analyzing mechanism it is carried forward between the feed rollers 5' and the cam 74 forces the printing roll 70 down on to the card 21. The link 78' holds the clutch 76 in operating position until the printing roll 70 is released by means of the cam 74. The spring 79 then brings the printing roll 70 back to its inoperative position and the clutch 76 is rendered inoperative.

It is to be understood that the improvements herein disclosed may be applied to any machines of the general type described, and the improved analyzing mechanism may be used in conjunction with sorting boxes, or any other devices which may be operated by mechanism responsive to the currents in the analyzing circuits. The term "selecting devices" as herein used is intended to include all such mechanisms.

I claim:

1. The process which consists in passing record cards through an analyzing device and closing contacts connected in series when cards having certain data thereon are analyzed, whereby a selecting mechanism is caused to operate.

2. The method of selecting record cards, which consist in closing contacts connected in series, when cards having certain data thereon are in a predetermined position, whereby electric current is caused to flow through a circuit to operate a selecting device.

3. The method of selecting record cards, which consists in connecting contacts in series, the contacts corresponding with certain spaces on said cards, and closing said contacts when a card having data recorded on the certain spaces is in a predetermined position, whereby electric current is caused to flow through a circuit to operate a selecting device.

4. The method of selecting record cards, which consists in passing an electric current alternately up and down through index points on certain of said cards.

5. The method of selecting record cards, which consists in passing an electric current alternately up and down through the index points on certain of said cards, and through a selecting device.

6. The method of selecting record cards, which consists in connecting elements of an analyzing mechanism in series, passing the cards through the analyzing mechanism and causing electric current to flow through said

elements to operate a selecting device when certain of said cards are analyzed.

7. The method of selecting record cards, which consists in connecting certain pins of a pin box analyzer in series, passing the cards through the analyzer and making electrical contact through index points in certain of said cards by means of said pins, whereby a selecting device is caused to operate.

8. The method of selecting record cards, which consists in connecting certain elements of an analyzing mechanism in series, and connecting this series group in parallel with certain other elements, passing the cards through the analyzing mechanism and causing electric current to flow through said elements to operate a selecting device when certain of said cards are analyzed.

9. The method of selecting record cards which includes placing the cards successively in position to control the movement of a plurality of contacts and moving such contacts to establish series circuits through them.

10. The method of selecting record cards which includes passing the cards between contact points connected in series and causing the contacts to be closed upon the passage of cards bearing predetermined data.

11. The method of selecting record cards which includes connecting selecting devices in series and closing the series circuits through these devices, the closing of the circuits being controlled by the cards.

12. The method of selecting record cards which includes connecting contact elements of an analyzing mechanism in series, moving the contacts to close the circuit through them and controlling this movement by means of the cards successively interposed in the path of movement.

13. The method of sorting record cards into groups bearing predetermined data which includes connecting movable contacts in series circuits, each of said circuits containing a selecting device for a card group, placing the cards successively in the path of travel of these contacts and controlling the operation of the selecting devices in accordance with the data carried by the cards.

14. A pin box consisting of a reciprocating plate having a plurality of pins mounted therein and insulated from each other, and a contact plate provided with a plurality of insulated contact elements co-operable with said pins, said pins and their associated elements being so arranged that they may be connected as desired in a multiplicity of circuits with at least some of the pins in series.

15. A pin box comprising a reciprocating plate, a plurality of pins mounted therein and insulated from each other, a contact plate, and a plurality of mercury cups mounted therein and insulated from each

other, said mercury cups, corresponding in number and arrangement with said pins.

16. A pin box comprising a reciprocating plate, a plurality of pins mounted therein and adapted to be electrically connected in series, a contact plate, and a plurality of contact elements mounted therein and adapted to be electrically connected in series.

17. In a pin box of the type described, a pin comprising a cylindrical casing adapted to be mounted in the reciprocating plate, a plunger within said casing and having a needle fixed to the lower end thereof, and compressible means for holding said plunger normally at the lower end of said casing.

18. In a pin box of the type described, a pin comprising a cylindrical casing closed at the top and adapted to be mounted in the reciprocating plate, a plunger within said casing and having a needle fixed to the lower end thereof, a flange in the lower end of said casing for guiding said needle and a coiled spring within said casing to render said needle and plunger yieldable.

19. A compound switchboard adapted to be used with sorting machines of the type described, comprising a lower switchboard having a plurality of contact elements mounted therein, an upper switchboard having a plurality of holes for receiving plugs, said upper switchboard being adapted to be readily removed from the lower switchboard.

20. A compound switchboard for use with sorting machines of the class described, comprising a pair of separable switchboard members, one of these members having a group of contact elements serving as terminals for operating devices, and the other member providing means to interconnect these terminals.

21. A compound switchboard for use with sorting machines of the class described comprising a plurality of separable switchboard elements, one of these members having a group of contact elements serving as terminals for operating devices, and each of the other members providing an index to these terminals and means to interconnect them.

22. A compound switchboard for use with sorting machines of the class described, comprising a plurality of separable switchboard members, one of these members having a group of contact elements adapted to be permanently connected to operating devices, and each of the other members providing mountings for a group of elements to cooperate with the elements of the first group and also having an index to the first group.

23. A compound switchboard adapted to

be used with sorting machines of the type described, comprising a lower switchboard having a plurality of mercury cups therein, an upper switchboard having holes therein corresponding in number and arrangement with the mercury cups, the holes of said upper switchboard being adapted to receive plugs, said upper switchboard being detachably mounted on said lower switchboard in such a manner that the plugs which may be inserted in the holes of the upper switchboard may extend into the mercury cups in the lower switchboard.

24. In a sorting machine of the type described, a mechanism for lifting a sorting box lid, comprising a disc, means for rotating said disc, a lug associated with said disc and adapted to the slide parallel to the axis of rotation of the disc, means for moving said lug into its operative position to lift the lid, and means for moving said lug into its inoperative position after the lid had been lifted.

25. In a sorting machine of the type described, a mechanism for lifting a sorting box lid, comprising a rotatable disc, a plurality of slidably mounted lugs in said disc, said lugs being adapted to be moved parallel to the axis of said disc, and means adapted to be actuated by an analyzer for moving one of said lugs to its operative position.

26. In a sorting machine of the type described, a mechanism for lifting a sorting box lid, comprising a circular disc, a shaft supporting said disc, a plurality of slidably mounted lugs arranged near the edge of said disc and adapted to project out on either side of said disc, means adapted to move one of said lugs into its operative position to lift the lid.

27. In a sorting machine of the type described, a mechanism for rendering the analyzer inoperative when no card is being analyzed, comprising a master pin and an electrical contact switch arranged in such a manner that the pin closes the switch only when a card is being analyzed.

28. In a sorting machine of the type described, a mechanism comprising a master pin and a switch arranged in such a manner that when a card is being analyzed, the master pin closes the switch after contact is made by the analyzer pins and opens the switch before the analyzer pins break contact, said mechanism being further arranged so that the switch may not be closed when no card is in the machine.

In testimony whereof I affix my signature.

EDWARD BABSON WHITTLESEY.