

Sept. 1, 1942.

M. MAUL

2,294,680

SORTING MACHINE FOR RECORD CARDS

Filed May 3, 1940

6 Sheets-Sheet 1

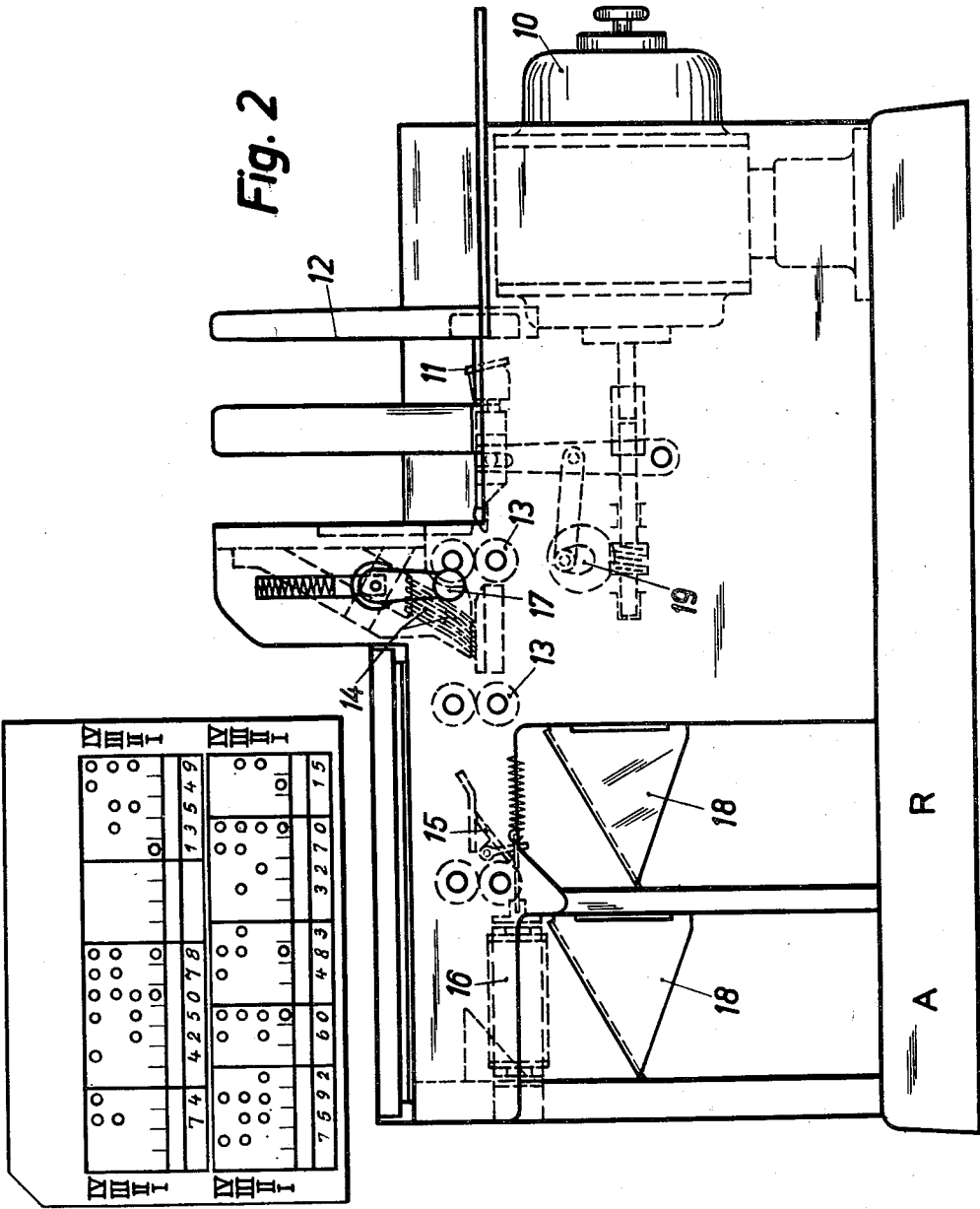


Fig. 1

Fig. 2

INVENTOR.
Michael Maul
BY *W. M. Wilson*
ATTORNEYS.

Sept. 1, 1942.

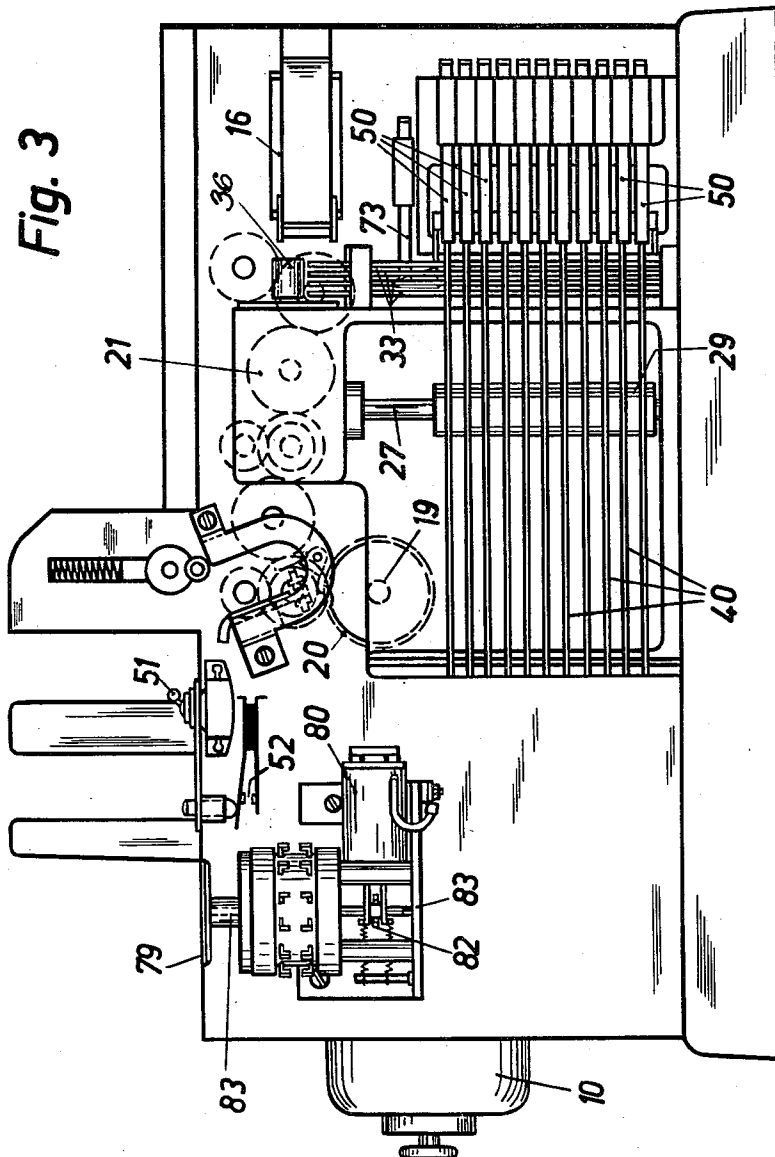
M. MAUL

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6 Sheets-Sheet 2



INVENTOR.
Michael Maul
BY *W. M. Wilson*
ATTORNEYS.

Sept. 1, 1942.

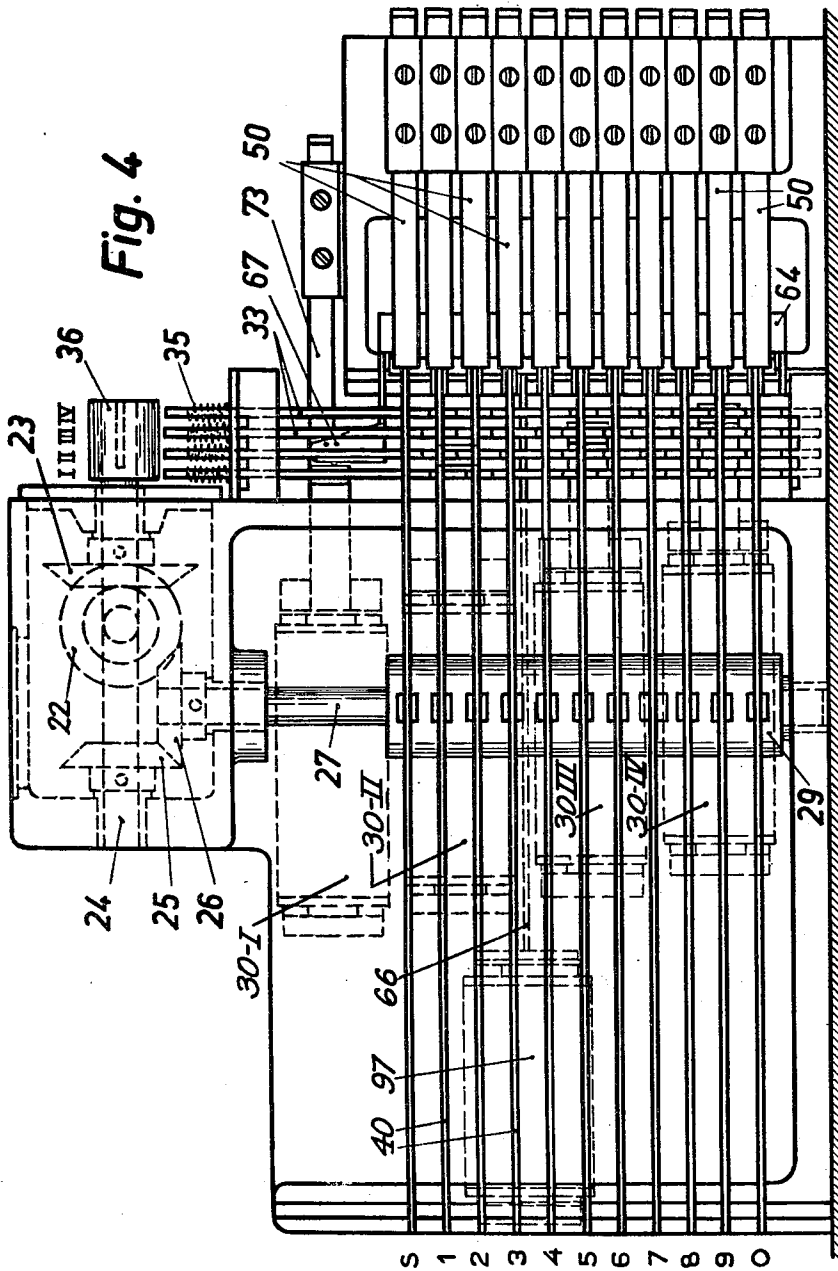
M. MAUL

2,294,680

SORTING MACHINE FOR RECORD CARDS

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6 Sheets-Sheet 3



INVENTOR.
Michael Maul
BY *W. M. Miskow*
ATTORNEYS.

Sept. 1, 1942.

M. MAUL

2,294,680

SORTING MACHINE FOR RECORD CARDS

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6 Sheets-Sheet 4

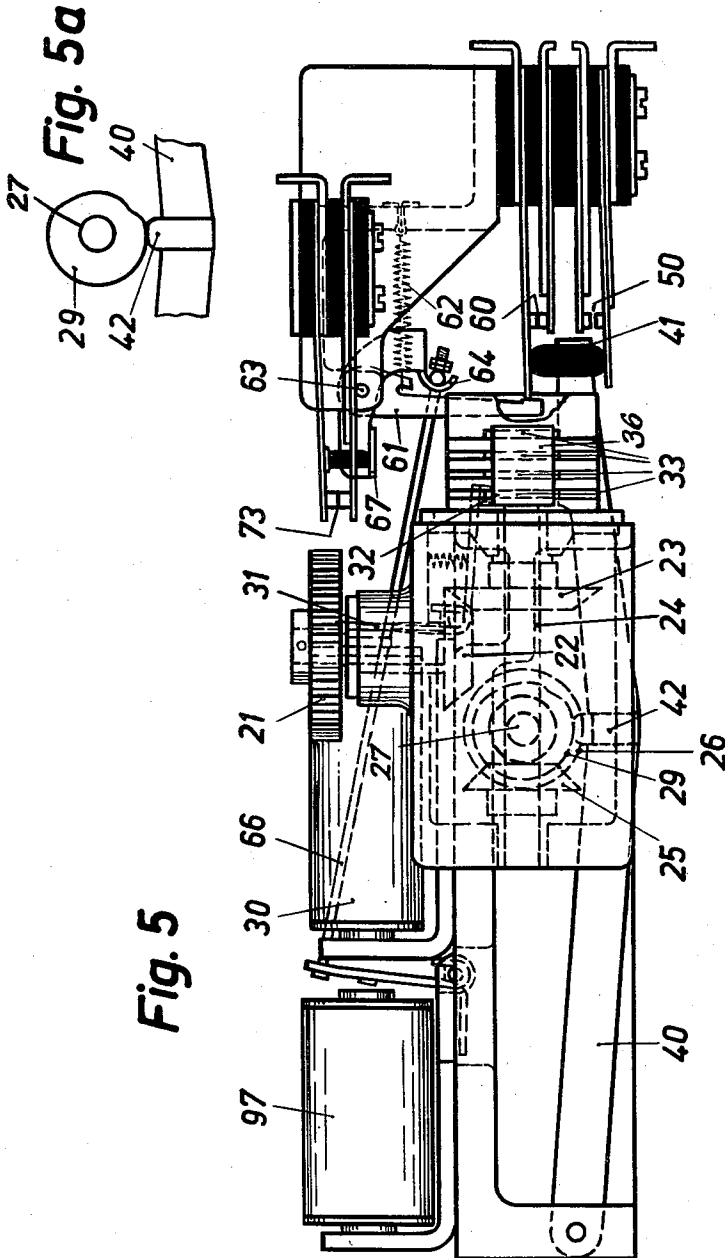


Fig. 5

INVENTOR.
Michael Maul
BY *W. M. Wilson*
ATTORNEYS.

Sept. 1, 1942.

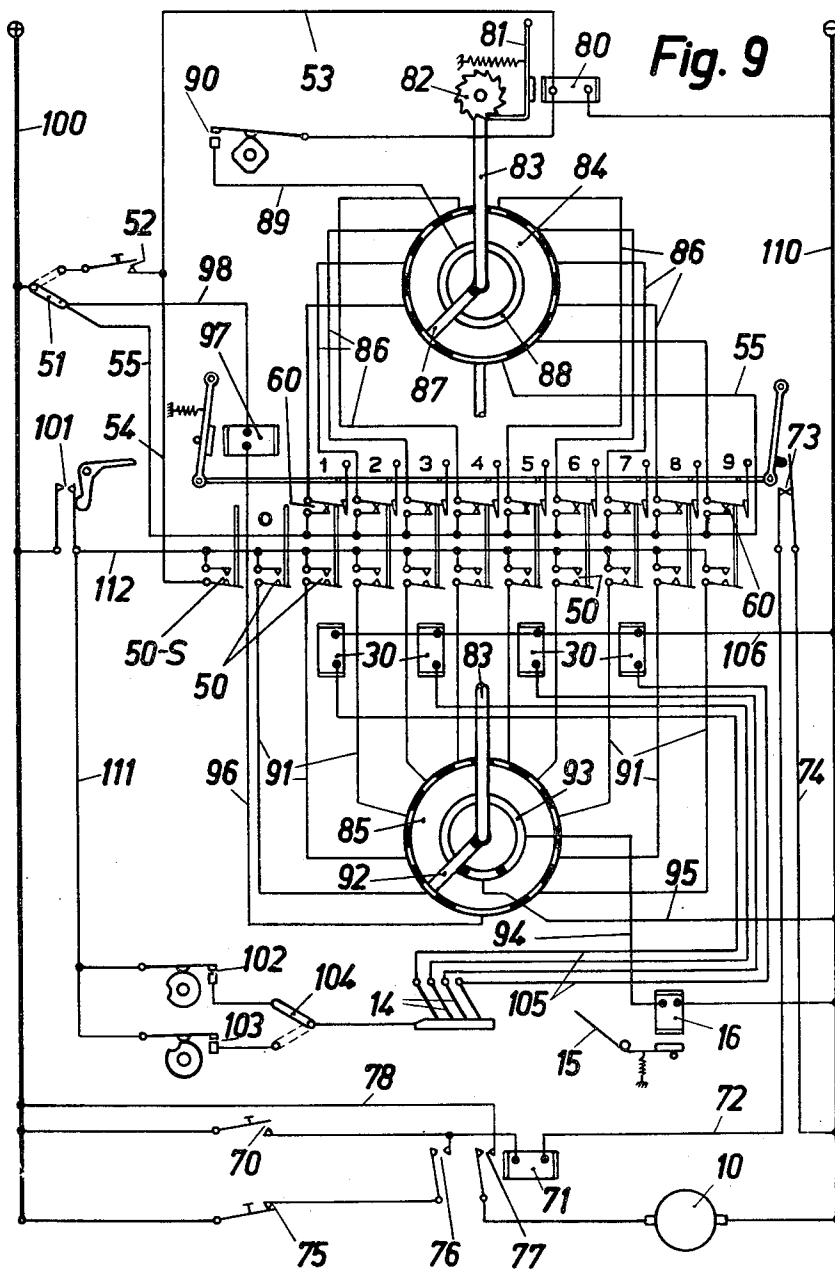
M. MAUL

2,294,680

SORTING MACHINE FOR RECORD CARDS

Filed May 3, 1940

6 Sheets-Sheet 6



INVENTOR.

Michael Maul

BY

W. M. Wilson
ATTORNEYS.

UNITED STATES PATENT OFFICE

2,294,680

SORTING MACHINE FOR RECORD CARDS

Michael Maul, Berlin-Johannisthal, Germany,
vested in the Alien Property Custodian

Application May 3, 1940, Serial No. 333,159
In Germany May 6, 1939

7 Claims. (Cl. 209—110)

The present invention relates to a sorting machine for record cards provided with a symbol selector adjustable for a plurality of symbols to be assorted, controlling the deposition of the assorted cards into an assorting pocket, and which sorting machine has further a reject card pocket into which all remaining cards are fed. Such machines have been used for assorting a certain symbol from a stack of cards as is shown in the machine in U. S. Patent 1,669,238. One can now use such a machine for the usual sorting according to a plurality of symbols if one adjusts the symbol selector after each assorting run to the next symbol in the ordinal sequence, leaving the cards in the assorting pocket, while for the following assorting run cards from the reject card pocket are placed into the magazine, so that after exhaustion of the card stack the cards lay superimposed in the assorting pocket according to the ordinal sequence. With such operation it is advantageous to shift the symbol selector automatically to the next symbol by means of a shift card added at the end of the card stack after each sorting run. Accordingly, in the first assorting run all "0"-symbols are assorted and fed into the assorting pocket; and when the shift card arrives the symbol selector will be shifted to "1," and from the cards removed from the reject card pocket and again inserted into the magazine all "1"-symbols are fed into the assorting pocket and the remaining cards into the reject card pocket. The operations will then be repeated for all symbols in the same manner so that finally in the assorting pocket the symbols are lying above one another in numerical sequence. In a machine of the above indicated type it is advantageous to provide a noting device which notes during the first sorting run the symbols non-existing in the card stack in the selected column because for these symbols, a particular assorting run is necessary and it is, therefore, possible to skip the corresponding positions of the symbol selector and to omit therewith the corresponding sorting runs. A method of operation as just described for a corresponding type of sorting machine is described in the application of Michael Maul, Serial No. 269,059, filed April 20, 1939.

The present invention relates to an improved modification of the machine constructed according to the last named application in the respect that the translator device for the hole combinations and the noting device for the symbol selector are combined in such a manner that a much simpler arrangement is obtained, because the

translator also assumes at the same time the function of an adjusting device for noting contacts of the noting device. In the invention, namely, provision has been made in such manner that with the use of an electro-mechanical translator for hole combinations known per se each selector member corresponding to a symbol will actuate (will for instance close) upon control by a corresponding hole combination a selector contact for the sorting magnet assorting the cards, and will simultaneously actuate (will open for instance) a noting contact, which noting contact causes in its starting position (for instance in closed position) a skipping of the corresponding symbol positions of the symbol selector. Provision has been made therein so that the selector contact for the sorting magnet will become effective (for instance will be closed only) instantaneously at each card passage. The noting contacts, however, will be latched after the initial actuation in the operative (for instance in the open) position and will automatically be released only under control of the symbol selector at the passing over of the same from the last to the first selecting position. Therewith, the mechanical contact arrangement will become very simple because latching by means of immediate locking of the one spring plate of a noting contact is effected by means of a shoulder on a latch lever. For the restoring of the latch levers a restoring magnet common to all levers is provided which is energized at the passage of the symbol selector from the last into the first selecting position and which simultaneously therewith interrupts the motor circuit so that the machine will automatically stop after assorting of all symbols of one card column. It is immaterial whether in the arrangement the open or the closed position is the starting position, since in any event the same effect may be obtained by the opening of contacts as well as by the closing of contacts.

An embodiment of the invention is illustrated in the accompanying drawings in which:

Fig. 1 shows a record card.

Fig. 2 shows the front view of the sorting machine being provided with two pockets.

Fig. 3 is a view of the rear side of the machine which shows the electro-mechanical translator as well as the symbol selector.

Fig. 4 shows the translator in an enlarged scale.

Fig. 5 is a plan view of the translator.

Fig. 5a is a detail.

Fig. 6 is a side view of the translator.

Fig. 7 illustrates the perforation code according to which the cards are punched.

Fig. 8 illustrates diagrammatically the arrangement of the selector levers of the translator with regard to the selector bars.

Fig. 9 is the wiring diagram of machine.

The construction of the machine and the manner of operation is generally as follows:

The cards are fed from a magazine past the analyzing brushes by means of the usual card feed device. The brushes analyze the hole combination and translate the same by means of the electro-mechanical translator into the individual symbol by closure of the corresponding selector contact. The selection of the symbols is effected by means of the symbol selector which connects one by one the different selector contacts to the sorting magnet. By displacement of the sorting chute the card with the assorted symbol will be fed into the assorting pocket and all remaining cards into the reject card pocket. In the first passage each noting contact for which a symbol exists will be opened by means of the electro-mechanical translator. The so opened and therewith latched noting contacts will remain latched during all assorting runs. The symbol selector always selects only one symbol. If anyone of the symbols was not present, which is determined in the first assorting run, the open noting contact will cause a skipping through the corresponding symbol selector position.

The card in Fig. 1 is divided into two superpositioned record decks each containing 20 columns and each column containing four hole positions. At the margin of the decks the designation of the hole positions is indicated by Roman numerals.

From the front of the machine viewed in Fig. 2 it may be seen that the shaft 19 is driven by the motor 10 through a worm gear which shaft makes one revolution for each card feed. The knife 11 is reciprocated by shaft 19 through a crank drive which knife feeds the cards singly from the magazine to the feed rollers 13. The hole combination is analyzed by the analyzing brushes 14 which are adjustable by means of the handle 17 in a known manner upon the various columns of the card. In the present instance four analyzing brushes are provided. The analyzing brushes 14 may selectively be rendered effective for a column of the lower or upper deck by means of the deck switch 104 which will later be described in connection with Fig. 9. Each hole combination will be translated into an individual symbol. By means of the symbol selector, however, only the desired symbol is selected and the related card fed into the assorting pocket A. If a card with a symbol to be assorted has been analyzed the sorting magnet 16 will be energized and will thereby pull the sorting chute 15 downwardly so that the card is fed over the sorting chute into the assorting pocket A. If the analyzed card contains a symbol which must be fed into the reject card pocket, the sorting magnet 16 will not be energized and therefore the chute 15 will direct all such cards into the pocket R. In the pockets the cards will drop upon the resiliently mounted card pocket bottoms 18.

Now, the construction of the "electro-mechanical noting translator" shall be described:

The noting translator is placed at the rear side of the machine in a particular casing. The translator consists essentially of the selector levers 40, the controlling bars 33, the selector con-

tacts 50 and the noting contacts 60 which are situated, in the illustration according to Figs. 3 and 4, behind the selector contacts. The control of the noting translator is effected under the supervision of the analyzing brushes by means of the releasing magnets 30^I, 30^{II}, 30^{III}, and 30^{IV}; and further, the controlling operations are controlled in mechanical manner. Restoring of the noting contacts is effected by means of the restoring magnet 97.

Altogether four controlling bars 33 are provided which are arranged side by side in the manner shown in the drawings. These controlling bars are pressed upwardly under the action of the springs 35 (Fig. 6). To each translator magnet 30 a controlling bar 33 is coordinated. The end of lever 32 of the armature 31 of each translator magnet engages a notch 34 of the coordinated controlling bar 33, so that the shoulder of this notch engages the lever 32. When the coordinated translator magnet is energized the armature lever will be disengaged from the shoulder 34 so that the controlling bar 33 will be pressed upwardly (Fig. 6) under the action of the spring 35. Therefore, depending upon the analyzed hole combination the controlling bars 33 will be adjusted in a differential manner and with each adjustment only one of the selector levers 40 can enter a gap formed by the controlling bars, whereby the analyzed hole combination will be translated into an individual controlling impulse. Electro-mechanical translators of this type are well known and, of course, any other kind of translator may be chosen.

Corresponding to the ten numerals 0-9 ten selector levers 40 are provided. A further lever 40^S can enter a gap of the translator bars 33 only by the combination designated in Fig. 7 as S. This combination is not a symbol but means that shifting of the symbol selector to the next symbol representation must be effected. Therefore, the shift card is perforated in all columns with the combination designated in Fig. 7 as S.

At a predetermined moment the selector levers 40 may be moved towards the controlling bars 33 in a manner still to be described and the selector lever corresponding to the analyzed combination will drop into a gap formed by the notches 45. The end of the selector lever which is provided with an insulation piece 41 (Fig. 5) is now pressed upwardly by the pressure of the plate spring of the plate spring contact 50. At this moment the contact 50 will close and the sorting magnet 16 will be energized, provided that the respective symbol is selected for assorting by the symbol selector. When the lever 40 rocks to close contacts 50 by its right hand end (Fig. 5), simultaneously the noting contact 60 will be opened. The upper plate spring of the noting contact engages behind the shoulder of the latch lever 61. Since all symbols will be translated, of course, in the first assorting run all those noting contacts 60 will be opened for which a symbol exists, and these contacts will remain in latched position by means of the levers 61. If a symbol does not exist the corresponding selector lever 40 cannot drop at all into the controlling bars 33 and therefore not only the selector contact 50 will remain open but also the noting contact 60 will remain closed. Accordingly, when the noting contact 60 is closed this means that the respective symbol does not exist.

The restoring of the noting contacts must always be effected after the last assorting run for a column when the symbol selector is passing

over from its last symbol selector position into the first symbol selector position. With this passing the restoring magnet 97 (Fig. 5) will be energized which will displace by means of its armature the bar 66. The bar 66 engages the middle portion of a restoring yoke 64 rotatable at 63 which rocks the latch levers 61 leftwardly (Fig. 5) so that the upper plate springs of all noting contacts 60 will again be unlatched and these contacts may close again. Integral with the restoring yoke 64 a side lip 67 is provided for actuating a contact 73. This contact controls by means of a relay the drive motor in a manner known per se so that with the passing over of the symbol selector from the last into the first selecting position the motor circuit will be interrupted by opening of the contact 73 and the machine will stop.

At the rear end of the crank shaft 19 (Fig. 2) a gear wheel 20 (Fig. 3) is provided driving over a chain of gears the feed rollers. In this chain of gears also a gear wheel 21 is inserted from which the drive for the electro-mechanical translator is derived (Figs. 3, 5, and 6). The gear wheel 21 is fast upon a shaft mounted in the casing at the other end of which a bevel wheel 22 is fastened engaging a bevel wheel 23. The latter is provided upon a shaft 24 upon whose right hand end (Figs. 4 and 5) which is outside of the casing a restoring cam 36 is seated. The relation of the ratio of the gear wheels 20, 21, and 22, 23, is so chosen that the shaft 24 with the restoring cam 36 makes the same number of revolutions as the card feed shaft 19, i. e. one revolution per card passage. At the other end of the shaft 24 is seated a bevel wheel 25 which drives in the relation 1:1 over a bevel wheel 26 the shaft 27 rotatably mounted in the casing and upon this shaft the controlling cam 29 is provided extending beneath all selector levers 40.

At the moment of the analysis of a hole combination the translator magnets 30 will be energized in the combination determined by the hole combination. The corresponding controlling bars 33 will therefore be released. The card will run further on and at the time it will approach the sorting chute 15 the selector bars 40 (Fig. 5) will move under the pressure of the spring of the plate spring contact 50 towards the rear side of the machine, which movement will be allowed by the rotating cam 29. Each selector lever 40 has a lip 42 riding upon the cam 29. The cam 29, making one revolution in each operation cycle and moving, of course, synchronously with all other parts, is so shaped that in a predetermined moment the selector levers 40 may rest upon the controlling bars 33. With the analyzed combination a gap will be formed by the notches 45 of the controlling bars 33 only for one selector lever, into which gap this selector lever may drop. The same will therefore close the coordinated selector contact 50 and open the corresponding noting contact 60 which latter will remain latched. This movement of the selector levers 40 is always affected shortly before the card edge will reach the chute, independent of the deck selection. The selector lever 40 dropped into the gap will hold the contact 50 closed a sufficient long time so that the sorting magnet may displace the chute 15 if the respective symbol shall be assorted. Shortly after the chute adjustment, when the leading card edge has already passed over the chute, in the case that the card belongs into the assorting pocket,

the selector levers 40 are again restored by the cam 29 into their starting position, and shortly afterwards the cam 35 (Fig. 6) will push the controlling bars 33 downwardly so that they are latched again in the position illustrated in Fig. 6.

The symbol selector is indicated in Fig. 3. It consists of a casing in which a symbol selector commutator and a skip commutator are provided. Through the symbol selector runs the shaft 83 upon the upper end of which an indicator disk 79 is situated and by means of a window of the casing the adjusted symbol is always made visible. Upon the shaft 83 the ratchet wheel 82 is provided which is shifted by means of the magnet 80 being controlled as to its energization by the shift card.

The wiring of the symbol selector may be seen in detail in Fig. 9. When the shift magnet 80 receives an impulse its armature 81 will rotate the ratchet wheel 82 and therewith the shaft 83 for one step. By means of the selector commutator 85 only one symbol is selected in an assorting run. In the position illustrated in Fig. 9 the selector commutator 85 is adjusted for the symbol "0." The selector arm 92 of the selector commutator 85 is fast upon the shaft 83 and can connect in a manner still to be described the selecting contacts 50 one by one to the sorting magnet. Upon the shaft 83 there is also secured the contact arm 87 of the noting commutator 84, to whose commutator spots the various noting contacts 60 are connected. For each selector contact there is provided a noting contact 60. For the symbol "0," however, a noting contact 60 is unnecessary, because the first assorting run is necessary in any event.

If a certain column shall be selected, the analyzing brushes 14 are adjusted to the desired column by means of the crank 17. Then the deck has to be selected in which the column is situated. For this purpose the switch 104 (Fig. 9) is adjusted into the upper or lower position according to the position of the column in the upper or lower deck. By means of the cam contact 102 the brush will only receive current when the upper deck is moving past the brushes, and by means of the cam contact 103 only when the lower deck is moving past the brushes so that due to the selective adjustment of the switch 104 the column of only one deck may become effective. The cam contacts 102, 103, are connected to the line 111, the latter being connected through the card lever contact 101 to the positive line 100. As soon as the cards are running through the machine the card lever contact 101 will be closed in the usual manner. The analyzing brushes 14 are connected by lines 105 to the translator magnets 30 which are connected by the common line 106 back to the negative line 110.

The starting of the machine is effected by depression of the start key and closure of the start contact 70 whereby the motor relay 71 will be energized. Therefore, the two relay contacts 76 and 77 will be closed and will also remain closed even if the start key is again released, because the relay establishes its own stick circuit over contact 75 and contact 76; and simultaneously the motor 10 will be switched across the lines by contact 77. If for any reasons the machine shall be stopped manually the stop contact 75 will be opened by key depression. Between the lines 72 and 74, in which circuit the motor relay 71 is arranged, the contact 73 is inserted which is opened in the manner already described

upon restoring of the noting device to its starting position. Since this restoring is effected upon the passing over of the symbol selector from the last into the first selecting position, the contact 73 will therefore be opened after assorting of a card column.

When the machine is adjusted for automatic shifting of the symbol selector by the shift card the switch 51 is in the position shown in Fig. 9. In the beginning of a sorting operation the symbol selector will assume the starting position also shown in Fig. 9.

Now, in the first assorting run each symbol will be translated and for all symbols present the corresponding contacts 60 will be opened. Supposing now, the symbols "3" and "5" were lacking, for these symbols a corresponding actuation of the contacts 50 and 60 will not take place and since, of course, these symbols can no more occur in the later assorting runs of the same card column, the noting contacts for the symbols "3" and "5" will remain closed. For all symbols present the selector contacts 50 will be closed. However, in the first assorting run only the "0" selector contact 50 can establish a connection with the sorting magnet 16. Therefore, in the first assorting run comprising the "0"-hole combination a current circuit may be established over contact 101, line 112, through the contact 50 corresponding to the "0"-position, corresponding line 91, contact arm 92, contact ring 93, line 94, and sorting magnet 16, to the negative line 110. At the end of the first assorting run the shift card will then arrive, closing the contact 50—S. Thus, with the passage of this card a current impulse can be effected over contact 101, line 112, contact 50—S, line 54, line 53, shift magnet 80 to the negative line 110. The shift magnet 80 will shift the shaft 83 for one step and therewith also the arms 92 and 87 will be adjusted to the next symbol. In the meantime, the operator could have transferred the cards from the reject card pocket into the magazine, so that in the next assorting run the "1"-symbol will be assorted. Since the corresponding noting contacts 60 have been opened and will also be latched in open position a current impulse cannot be sent from the line 100 over line 55, noting contact 60 of the noting commutator 84. The assorting runs will now continue in the described sequence and after each passage of the previous rejected cards the shift card will cause a shifting of the symbol selector. The symbol "2" will be assorted and afterwards the symbol selector will be shifted to the position "3." In this position, however, as has been assumed, the noting contact 60 is closed so that a current impulse can be sent from the line 100 over line 55, noting contact 60 of the "3"-position, corresponding connection line 86, arm 87, contact ring 88, line 89, the intermittently closing contact 90, shift magnet 80 to the negative line 110. The shift magnet circuit will at once be interrupted by opening of contact 90 and thus will cause a shifting of the symbol selector to the next position so that one assorting run will be skipped. When the symbol selector is in the "4"-position, the cards having a "4" symbol will be assorted, since an automatic skipping of the "4"-position is impossible because the corresponding noting contact 60 is opened. When the symbol selector is shifted from the "4"-position to the "5"-position, a skipping of the "5"-position will again take place since the corresponding noting contact 60 has remained closed in the example assumed. Then the op-

erations will continue in normal manner until the symbol selector has effected a full revolution. Between the last and the first selector position the symbol selector will make two contact steps because current is supplied to the shift magnet 80 over the line 55. During this passing the arm 92 of the selector commutator 85 establishes a current circuit through switch 51, line 98, restoring magnet 97, line 96 to the line 95 and line 110 so that the restoring magnet 97 will cause in the described manner the restoring of the noting contacts and simultaneously the contact 73 will be opened. The machine will still run a sufficient long time until the symbol selector has again reached the "0"-position and will then stop.

It may also be desirable to accomplish the assorting of the symbols without the use of a shift card by manually adjusting the symbol selector to the next selecting position; or it may be desirable to utilize the machine in a manner known per se for assorting of a single symbol. For that purpose the switch 51 is rocked upwards (Fig. 9) so that it will establish a connection between the line 100 over the contact 52 to the line 53. If then the contact 52 is repeatedly depressed by key actuation, by means of the successive shift impulses transmitted to magnet 80 an adjustment of the symbol selector to any desired symbol may take place.

What is claimed is as follows:

1. In a sorting machine, the combination of analyzing devices for analyzing designations on records to be sorted, said designations being represented by holes in combinational arrangement, a sorting mechanism, a digit designation selector which in successive digit representing positions causes the sorting mechanism to be successively responsive to the translated digit representing readings of the designations, an electro-mechanical translator comprising permutation bars electro-magnetically set under control of such analyzing devices and including digit representing bars cooperative with said permutation bars for controlling said sorting mechanism digit representing set-up devices, means directly controlled by said digit representing bars to set up on said devices the different digit representations of the records analyzed by said analyzing devices, and means controlled by said set-up devices for causing said digit designation selector to be moved from one digit representing position to another digit representing position which correspond to digits represented by said set-up devices, to cause said sorting mechanism to be responsive only to translated digit readings represented by records analyzed by said analyzing means.

2. In a sorting machine, the combination of analyzing devices for analyzing designations on records to be sorted in successive sorting runs according to successive designations, said designations being represented by holes in combinational arrangement, a sorting mechanism, a digit designation selector, means for causing said selector to be moved to successive digit representing positions for successive sorting runs to cause the sorting mechanism to be successively responsive to the translated digit representing readings of the designations, an electro-mechanical translator comprising permutation bars electro-magnetically set under control of such analyzing devices and including digit representing bars cooperative with said permutation bars for controlling said sorting mechanism digit representing set-up devices, means directly controlled by

said digit representing bars to set up on said devices during the first sorting run the different digit representations of the records analyzed by said analyzing devices, and means controlled by said set-up devices for causing said digit designation selector to be moved at the termination of a sorting run from one digit representing position to another digit representing position which correspond to a digit represented by said set-up devices to cause said sorting mechanism to be responsive during the next sorting run to translated digit readings represented by records to be sorted during that sorting run.

3. In a sorting machine, the combination of analyzing devices for analyzing designations on records to be sorted in successive sorting runs according to successive designations, said designations being represented by holes in combinational arrangement, a sorting mechanism, a digit designation selector, means including a control record comprising the last record in each sorting run to cause said selector to occupy successive digit representing positions to cause the sorting mechanism to be successively responsive to the translated digit representing readings of the designations, an electro-mechanical translator comprising permutation bars electro-magnetically set under control of such analyzing devices and including digit representing bars cooperative with said permutation bars for controlling said sorting mechanism digit representing set-up devices, means directly controlled by said digit representing bars to set up on said devices during the first sorting run the different digit representations of the records analyzed by said analyzing devices during the first sorting run, and means controlled by said set-up devices for causing said digit designation selector to be moved at the termination of a sorting run from one digit representing position to another digit representing position which correspond to a digit represented by said set-up devices to cause said sorting mechanism to be responsive during the next sorting run to translated digit readings represented by records to be sorted during that sorting run.

4. A sorting machine provided with the structure defined in claim 3 in which means is provided for said set-up devices for retaining them in their set-up positions during all the sorting runs, and means controlled by the digit designation selector and responsive to its digit representing position corresponding to the digit of records to be sorted during the last sorting run for disabling the aforesaid retaining means.

5. A controlling device for a digit designation selector which successively selects the designations represented by perforated records to be sorted during successive sorting runs comprising, analyzing devices for analyzing the combinationally arranged perforations on the records to be sorted, a plurality of differently notched translating bars set in different combinations under control of said analyzing devices, a plurality of digit representing bars cooperating with said notched bars, one of said digit representing bars cooperating with correlated notches of said notched bars to thereby represent by an off-normal position of the digit representing bars the digit represented by the perforations analyzed, a plurality of sets of contacts, one set for each digit representing bar and operated by

the off-normal position of the related bar, means for effecting under control of the operated contacts a step by step movement of the digit designation selector during successive sorting runs to select successive digit designations, and means under control of the unoperated contacts to effect a positioning of the digit selector from one digit representing position to another digit representing position corresponding to the digital representation of the records to be selectively sorted in the next sorting run.

6. A controlling device for a digit designation selector which successively selects the designations represented by perforated records to be sorted during successive sorting runs comprising analyzing devices for analyzing the combinationally arranged perforations of all the records first passed through the machine, a plurality of differently notched translating bars set in different combinations under control of said analyzing devices according to the combinational hole arrangement, a plurality of digit representing bars cooperating with said notched bars, one of said digit representing bars cooperating with correlated notches to thereby represent by its off-normal position the digit represented by the perforations analyzed, a plurality of sets of contacts, one set for each digit representing bar and operated by the related bar, means for effecting under control of the operated contacts a step by step movement of the digit designation selector during successive sorting runs to select successive digit designations, means for latching said operated contacts in operated position during successive sorting runs, means under control of said unoperated contacts to effect a direct positioning of the digit selector from one digit representing position to another digit representing position corresponding to the digital representation on records to be sorted during the next sorting run, and means responsive to the final digit representing position of the designation selector to disable the latching means.

7. A controlling device for a digit designation selector which successively selects the designations represented by perforated records to be sorted during successive sorting runs comprising analyzing devices for analyzing the combinationally arranged perforations on the records analyzed during the first sorting run, a plurality of differently notched translating bars set in different combinations under control of said analyzing devices, a plurality of digit representing bars cooperating with said notched bars, one of said digit representing bars cooperating with correlated notches of said notched bars to thereby represent by an off-normal position of the digit representing bars the digit represented by the perforations analyzed, a plurality of sets of contacts, one set for each digit representing bar and operated by the off-normal position of the related bar, and means for effecting during successive sorting runs and under control of said operated and unoperated contacts the position of said digit designation selector to cause said digit selector to have successive digit representing positions corresponding to the digit representations of the records, and to be positioned to omit digit representing positions corresponding to digit positions not represented by the records analyzed during the first sorting run.

MICHAEL MAUL.