Jan. 15, 1929. 1,698,844

E. A. FORD

SORTING MACHINE

Filed Nov. 15, 1924 4 Sheets-Sheet 1

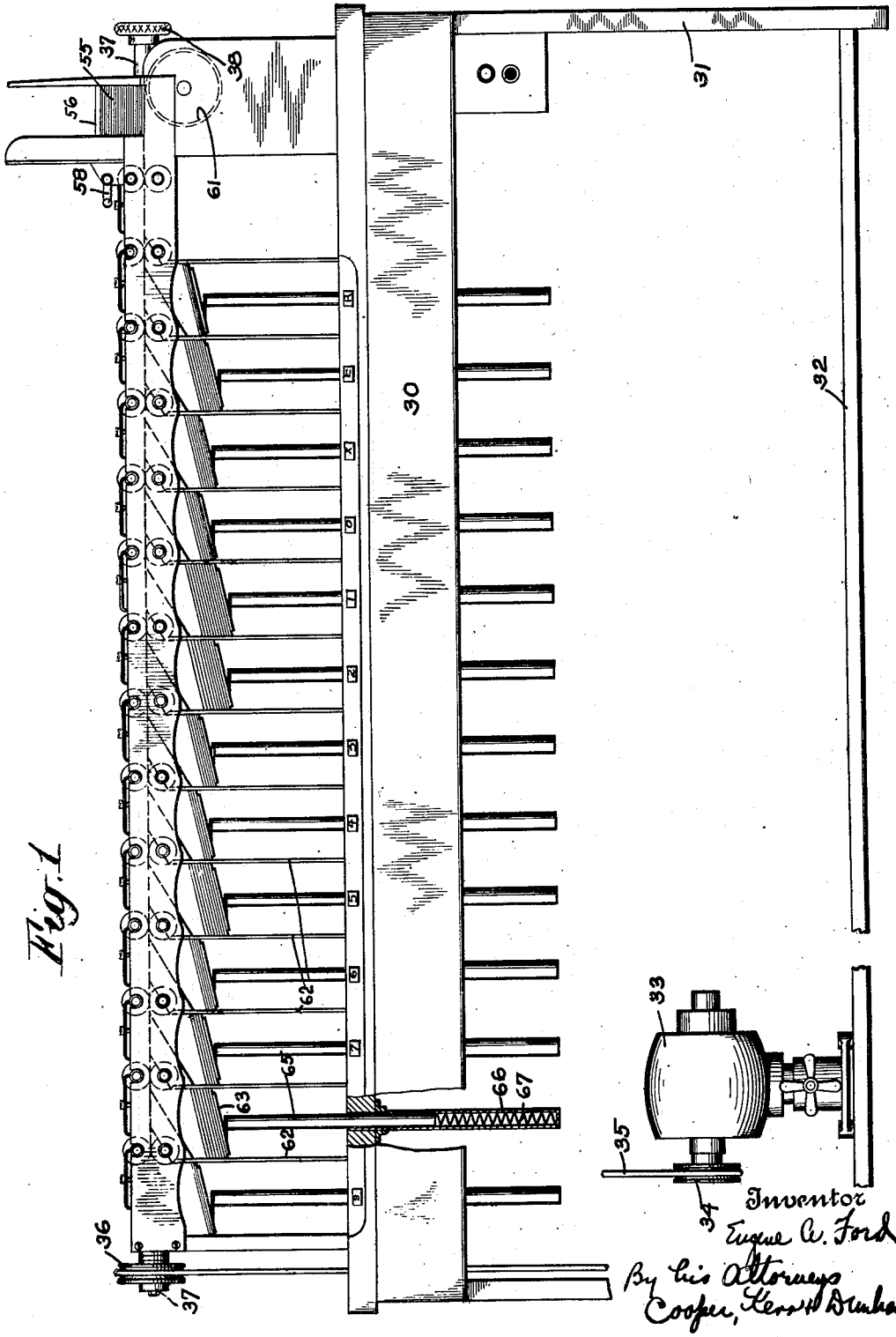


Fig. 1.

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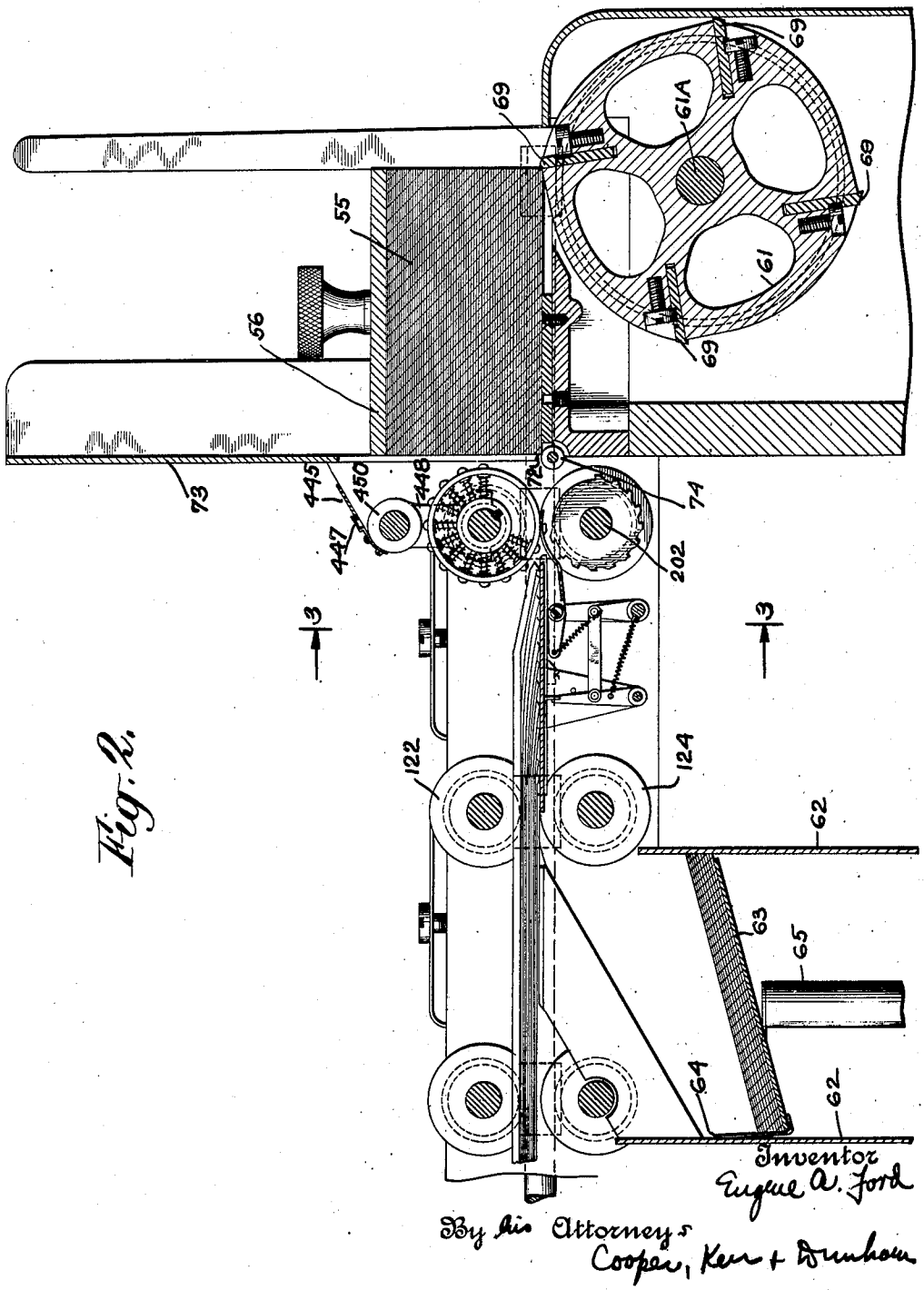


Fig. 2.

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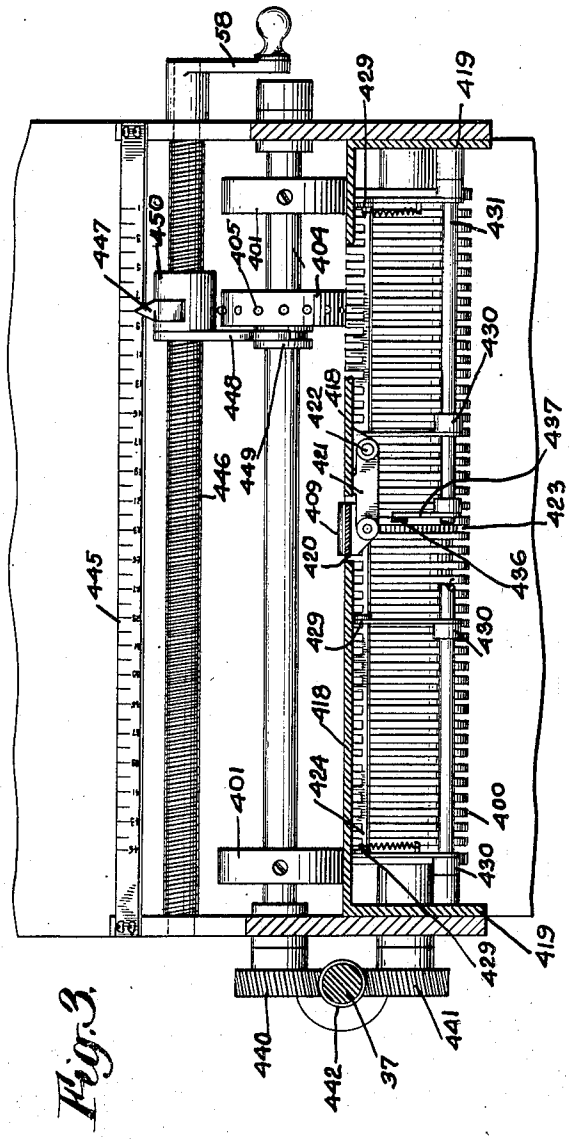


Fig. 3.

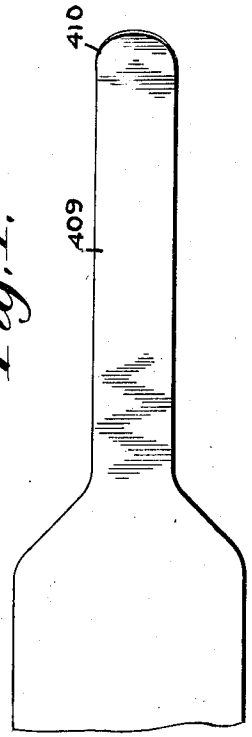


Fig. 4.

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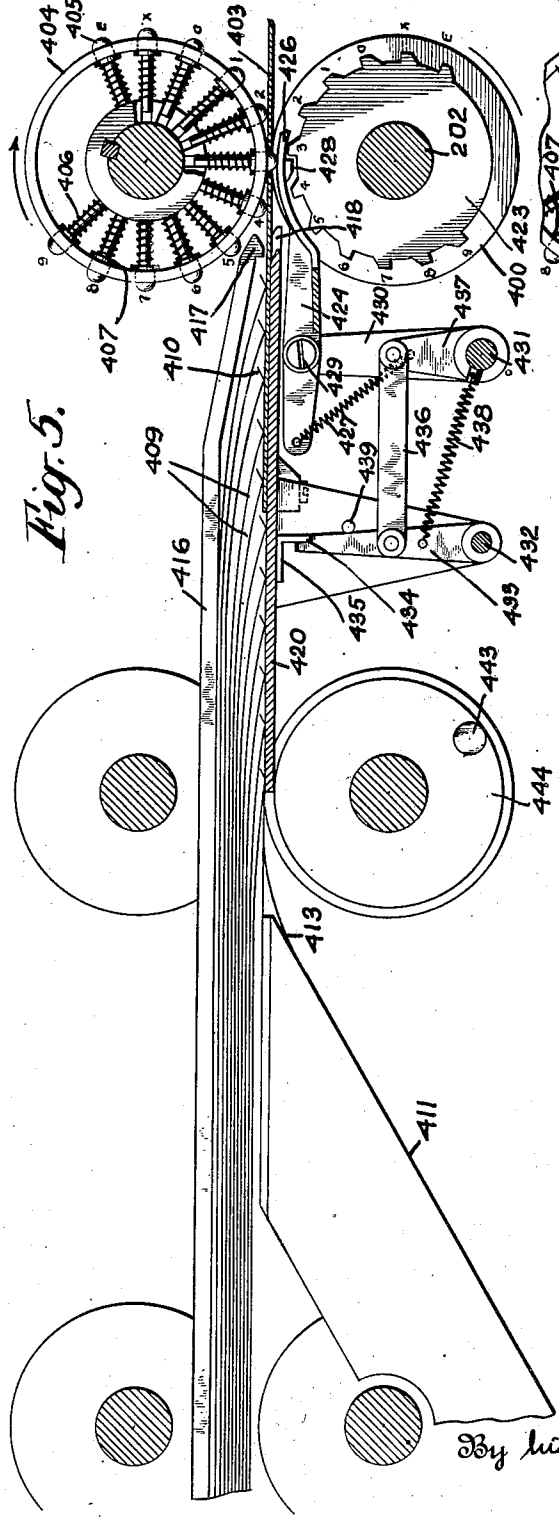


Fig. 5.

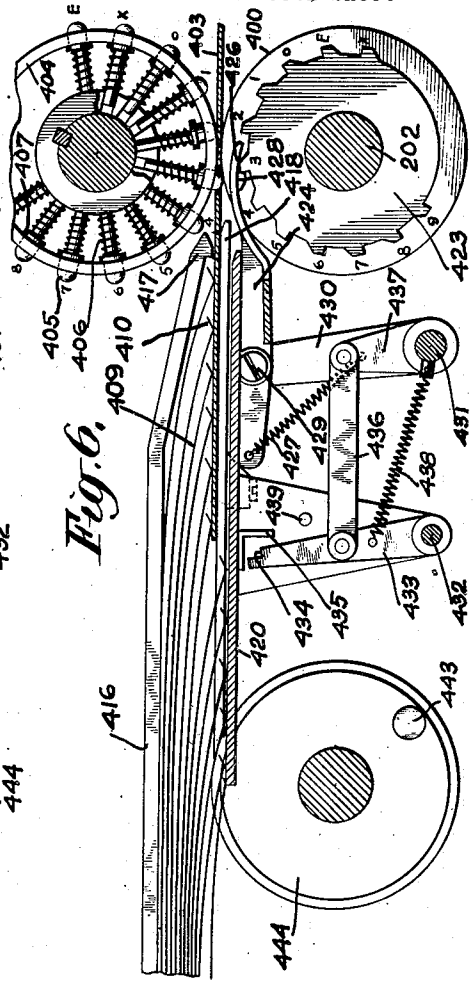


Fig. 6.

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Patented Jan. 15, 1929. 1,698,844

UNITED STATES PATENT OFFICE.

EUGENE A. FORD, OF SCARSDALE, NEW YORK, ASSIGNOR TO THE TABULATING MACHINE COMPANY, OF ENDICOTT, NEW YORK, A CORPORATION OF NEW JERSEY.

SORTING MACHINE.

Application filed November 15, 1924. Serial No. 750,024.

This invention relates to machines especially adapted for sorting cards used in tabulating systems, such, for instance, as the well known Hollerith.

Index points are formed by punching holes through the cards, the value and character of the information conveyed by each hole being dependent on its exact location on the card. The index points are arranged in vertical columns, and certain columns contain punched index holes designating the kind or class to which the card belongs.

As it would be a tedious task to sort out the cards by hand into desired classes or groups before running them through the tabulating machines, sorting machines have been designed to do the classifying automatically, and that is the class of machine to which my present invention belongs, being an improvement on the machine described in detail in my copending application Serial No. 748,347 which discloses a sorter of the horizontal type designed to sort the cards electrically and deposit each class in a certain station.

My present invention pertains to a strictly mechanical (as distinguished from electrical) method of analyzing the cards and of controlling the receiving ends of the blades which conduct each card to its station, after the selecting or analyzing device indicates to which station it should go.

Fig. 1 is a front elevation of my sorting machine complete.

Fig. 2 is a section through the feeding and analyzing portion of the machine.

Fig. 3 is a section as indicated by 3—3 in Fig. 2.

Fig. 4 is a top view of the receiving end of a distributing blade.

Fig. 5 is an enlarged view, partly in section, showing the selector wheel and blade control mechanism.

Fig. 6 is a view of same portion of the machine as Fig. 5 but with parts in a different operative position.

Referring to Fig. 1, the frame 30 is mounted on legs 31. Underneath the main frame and carried by the legs is a shelf or subframe 32 supporting the motor 33 which drives the machine by pulley 34 by belt 35 to pulley 36 secured to shaft 37 which runs the full length of the machine, in the rear, pulley 36 being on one end of it and handwheel 38 on the other. Motor 33 is shown slightly displaced from its true position in order to save space in the drawing.

In operation, a stack of cards to be sorted is placed in the feed magazine, as at 55, with plate 56 on top of the stack. The operator, by means of hand crank 58 moves the analyzing or selecting wheel so it will traverse the desired index column on the cards as they pass under it. When the motor has been started, picker drum 61, geared to shaft 37, rotates, and feeds the cards one by one from the bottom of the stack into the analyzer, whence the passage of each card is directed between successive pairs of rolls into one of the thirteen receiving stations R, E, X, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.

Each receiving station consists of a compartment formed by the vertical walls 62, in which is an inclined tray 63 having vertical fingers 64 extending upwardly from its lower edge. Each tray is carried by a vertical plunger 65 which extends downwardly into a cylinder 66, wherein the plunger is supported by a coil spring 67 of such resiliency as to gradually sink as its load of cards increases, always maintaining the top of its stack at or near the top of its compartment.

The feed mechanism consists of the rotary picker drum 61, mounted on shaft 61A and turning with it. Drum 61 carries in its rim a number of picker blades 69 extending lengthwise of the drum and projecting from the drum a distance slightly less than the thickness of a card. As the drum revolves each blade in turn picks a card from the bottom of the stack 55 and feeds it through the micrometer openings 72 provided between the fixed plate 73 and rollers 74, into the control of the analyzing and distributing system.

Analyzing and distributing system.

The principle of my analyzing and distributing system may be readily understood from Figs. 3, 5, and 6, in which 400 is a cylinder extending crosswise of the machine, its surface being cut into a series of equal, and equally spaced, circumferential grooves. 401 is a pair of rollers pressed downwardly against cylinder 400. 403 represents a card passing between cylinder and rollers. 404 is a selector wheel carrying a plurality of radial plungers or pins 405, each pressed outwardly by a spring 406 surrounding the shank of plunger 405 and compressed be-

tween the hub of the wheel and the collar 407, which is integral with the plunger. Each pin, or plunger, has a tip with a spherically shaped end extending a short distance beyond the rim of selector wheel 404. The pins 405 are spaced to correspond to the index positions on a card column, so that as a card is fed between cylinder 400 and selector wheel 404, each plunger in turn will rest on its corresponding position on the card.

409 are a plurality of flexible blades, each one shorter than the one above it, and all spring-biased downwards. The tips of the blades are slightly upturned as at 410. The receiving ends of these blades are narrowed relatively to the main portions, as shown in Fig. 4. The other ends of the blades are successively attached to brackets 411, one above each receiving station, the lowest blade going to station R, the second from the bottom going to station E, third to station X, fourth to station 0, fifth to station 1, and so on to station 9. The discharge end of each blade is attached on top of bracket 411, but a lip 413 punched from the center of the blade, is bent downwardly below bracket 411 the better to guide arriving cards. 416 is a plate extending lengthwise of the machine above the blades, and 417 is its end, shaped to guide the cards between the blade ends 410 and plates 418, which are rigidly secured to the frame of the machine by their angle portions 419.

The plane of the top of the plates 418 is tangent to the top of cylinder 400. Plate 420, carried on arm 421, which is pivoted at 422, occupies the longitudinal space between the edges of plates 418, and in normal position its top is flush with tops of plates 418. The downwardly-spring-biased blade ends 410 rest on plate 420.

In the center groove of cylinder 400, directly under plate 420, is placed a toothed wheel 423, having teeth spaced the same as the plungers in selector wheel 404. This toothed wheel turns with cylinder 400. Extending crosswise of the machine, is a comb-shaped member 424 so located that one tooth 426 is disposed in each groove of cylinder 400, the convexly-curved top surfaces of the comb teeth being normally held, by spring 427, lightly pressed against the bottom surface of the passing record card. The comb tooth in cylinder groove occupied by toothed wheel 423 has on its under surface a projection 428, so placed that if the comb be pressed downwards the projection 428 will be engaged by a tooth on the revolving wheel 423.

Comb 424 is pivoted at 429 to the upper ends of arms 430, which in turn are fixed at their lower ends to rock shaft 431 extending crosswise of the machine. Carried on a similar and parallel shaft 432 is an upwardly extending arm 433 having a shoulder 434 at its upper end, on which, in normal position, rests the angle piece 435 which is rigidly attached to plate 420 thereby holding plate 420 in its normal raised position. Midway of its length arm 433 is connected by link 436 to arm 437 attached to shaft 431, and moving in unison with arms 430. This entire link system is drawn to the right by spring 438 extended between arms 433 and shaft 431. Pin 439 serves as a stop for arm 433.

Cylinder 400, selector wheel 404, and all rollers, are positively driven by pairs of spiral gears 440 and 441, which in turn are driven by worm 442 on shaft 37. The cylinder and all the rolls below the card turn counter-clockwise, while the selector wheel and all the upper rolls turn clockwise, so as to draw the card between them. Pin 443 on disc 444 restores plate 420 to its normal raised position after passage of each card, in which position plate 420 is latched by shoulder 434.

The columns on Hollerith cards are numbered 1 to 45, and my machine carries an index bar 445 also numbered 1 to 45, so located that when screw 446 is turned by hand crank 58 until pointer 447 points to any particular number on the index bar, then selector wheel 404 is so placed that it will be controlled by the column bearing that same number. For instance in Fig. 3 the selector wheel is in position to traverse column 8 of the record card. Wheel 404 is moved by screw 446 through arm 448 engaging collar 449 on the hub of the wheel and having its upper end fast to the threaded nut portion 450.

Operation.

While my machine is sorting a promiscuous stack of cards, each card as it comes from the feeding mechanism, is passed over cylinder 400, with selector wheel 404 rolling on the top surface of the card, with each pin or plunger 405 contacting with its corresponding index position in the column being analyzed. If the pins find no hole in the card column, the pins 405 will simply be pushed in, against their springs, when they contact with the card, and the card will pass along above plates 418 and 420, but underneath all the upturned blade ends 110, into the first receiving station, designated R, or "Reject."

If, however, a pin finds a hole in a card, it will pass through the hole and push down the end 426 of comb 424. This will allow a tooth on wheel 423 to engage shoulder 428 on the center tooth of the comb, and thereby push the comb to the left (Figs. 5 and 6) and through the agency of arms 430, 437, link 436, and arm 433, unlatch shoulder 434 from under 435, so that plate 420 swinging on its arm 421, will drop, followed by all the downwardly-spring-biased ends of blades 109 which are not prevented by the card itself, and we have the condition shown in Fig. 6, wherein it is evident that further progress

of the card to the left will direct it into the passage between the 5th and 6th blades (counting from the right) and the card, as it passes between the succeeding sets of rolls, will be confined to that passage, which ends in station 3. It is evident that the destination of each card depends on how far the card has advanced underneath the blades 109 at the instant the comb is depressed, and that instant depends on the location of the hole in the card.

The cards are fed bottom first and the selector wheel passes over the index positions in any column in the order 9, 8, 7, 6, 5, 4, 3, 2, 1, 0, followed by the two extra positions. These extra positions correspond to stations X and E respectively.

Ends 110 of the blades are so positioned relative to the selector wheel that if a 405 selector pin finds a hole at index position 9, the comb will have been depressed, plate 420 will have dropped, before the advancing edge of the card has reached the first blade, and as all the blades will have followed plate 420 downwards, the card will pass above all the blades and be conducted by the rollers to the furthest station, which No. 9. If the wheel does not find a hole in the card until index position 8 is reached, the card will have advanced far enough to prevent the end of the first blade from following plate 420 downwards when the comb is actuated, but all the other blades will have dropped, and the card will pass between the first and second blades to station No. 8, and so on, each card going to the station indicated by its index hole. It will be understood that the thickness of the blades is much less than indicated by the drawings, so they must bend only very slightly in order to permit the cards to travel in the plane between the rollers.

I claim:—

1. A mechanical card sorting machine comprising mechanical card analyzing means including elements movable into and out of searching position for each index point position of a card, means forming a plurality of distributing passages, means operated by said elements and including an analyzed card constituting a passage producing element to select a distributing passage for itself according to its analysis by the analyzing means.

2. A mechanical card sorting machine comprising mechanical card analyzing means including elements movable into and out of searching position for each index point position of a card, means forming a plurality of distributing passages, means operated by said elements and including an analyzed card cooperating with said passage forming means to constitute a passage opening element to select a distributing passage for itself according to its analysis by the analyzing means.

3. A mechanical card sorting machine comprising mechanical card analyzing means including elements movable into and out of searching position for each index point position of a card, a plurality of blades forming distributing passages between them, means operated by said elements and including an analyzed card cooperating with said blades to constitute a passage opening element to select a distributing passage for itself according to its analysis by the analyzing means.

4. A mechanical card sorting machine comprising mechanical card analyzing means including elements movable into and out of searching position for each index point position of a card, a plurality of blades forming distributing passages between them, means including a movable member operated by said elements and an analyzed card cooperating with said blades to constitute a passage opening element to select a passage for itself according to its analysis by the analyzing means.

5. In a card sorting machine, in combination, means for analyzing a card, said analyzing means comprising an analyzing wheel with outwardly pressed plungers, a plurality of distributing passages, a mechanism operable by the analyzing means to open the receiving end of a passage for the card, the position of the card itself aside from its cooperation with the analyzer determining which passage shall be opened.

6. In a machine for sorting record cards having index points, in combination, an analyzer comprising a wheel with plungers, a plurality of distributing passages normally closed, mechanism to open a distributing passage, said mechanism being operable by one of said plungers when it finds a perforation in the card, the particular passage opened depending on the position of the card aside from its cooperation with the analyzer at time of operation.

7. In a machine for sorting record cards, an analyzer, a toothed wheel rotating continuously, an operating mechanism, and means to actuate said operating mechanism from said toothed wheel whenever the analyzer finds a hole in a card.

8. In a machine for sorting record cards, in combination, an analyzer, an operating mechanism, an actuating member comprising a toothed wheel arranged to actuate the operating mechanism whenever said mechanism is placed in engagement with said actuating member by the analyzer.

9. In a machine for sorting record cards, in combination, an analyzer, an operating mechanism comprising a linkwork, a toothed wheel, said toothed wheel actuating the operating mechanism whenever the analyzer places a member of the linkwork in engagement with said toothed wheel.

10. In a machine for sorting record cards,

in combination, an analyzer comprising a wheel with plungers, a linkwork, a toothed wheel, said toothed wheel actuating the linkwork whenever one of said plungers places the toothed wheel and linkwork in engagement.

11. In a machine for sorting record cards, in combination, an analyzer comprising a wheel with plungers, a plurality of distributing passages under control of said analyzer, a linkwork, a movable member operable by the linkwork to open a distributing passage for a card, the particular passage opened depending on the position of the card at the time of operation of the movable member.

12. In a machine for sorting record cards having index points, in combination, an analyzer comprising a wheel with plungers spaced to correspond with index positions in the card column, a cylinder grooved to correspond to columns on the card, a comb-shaped member with one tooth in each groove of said cylinder, and operable by said plungers, and a plurality of distributing passages; said comb-shaped member being operable by the analyzer to open the receiving end of a passage for a card, the particular passage opened depending on the position of the card.

13. In a machine for sorting record cards having index points, in combination, an analyzer comprising a wheel with outwardly pressed plungers spaced to correspond to the index positions on the card, a comb-shaped member, a plurality of distributing passages, the comb-shaped member being operable by the analyzer to open the receiving end of a passage for a card, the particular passage opened depending on the position of the card aside from its cooperation with the analyzer.

14. In a card sorting machine, in combination, a feeding mechanism, an analyzer comprising a wheel with plungers, an actuating member, a linkwork, a plurality of receiving stations, a passage from the analyzing device to each of the receiving stations; said linkwork being operable by the analyzing device to open one of the distributing passages for a card, the particular passage opened depending on the position of the card aside from its cooperation with the analyzer.

15. In a machine of the character described, in combination, mechanical means for analyzing a card including elements movable into and out of searching position for each index point position, a plurality of distributing passages, a mechanism operable by the analyzing means to open the receiving end of a passage for the card, said mechanism including means overlapping the card when it is in analyzing position and movable against the card to open the passage.

16. In a machine of the character described, in combination, mechanical means for analyzing a card including elements movable into and out of searching position for each index point position, a plurality of blades, a movable member operated by said elements, said movable member operating in conjunction with the card acting as a stop member, to open a passage for the card between the blades.

17. In a machine of the character described, in combination, mechanical means for analyzing a card having differentially located index point positions, said means including elements movable into and out of searching position for each index point position, a plurality of superimposed blades each blade having its end longer than that of the lower adjacent one, means operated by said analyzing means on encountering an index point for effecting movement of said blades, said blades being located so that a card being analyzed will project into the path of travel of their ends whereby such a card will act as a stop member for certain of the blades to open a passage for itself between them.

18. In a machine of the character described, in combination mechanical means for analyzing a card including elements movable into and out of searching position for each index point position, a plurality of superimposed blades and means for separating said blades to open a receiving passage for the card, said means comprising mechanism operated by the analyzing means on encountering an index point for moving the blades and the card being analyzed as a stop member therefor.

19. In a machine for sorting cards, an analyzer, a continuously rotating wheel having projections on its periphery, an operating mechanism comprising a movable member and means for moving said member into cooperative relationship with said projections to drive said operating mechanism whenever the analyzer encounters an index point on a card.

In testimony whereof I hereto affix my signature.

EUGENE A. FORD.